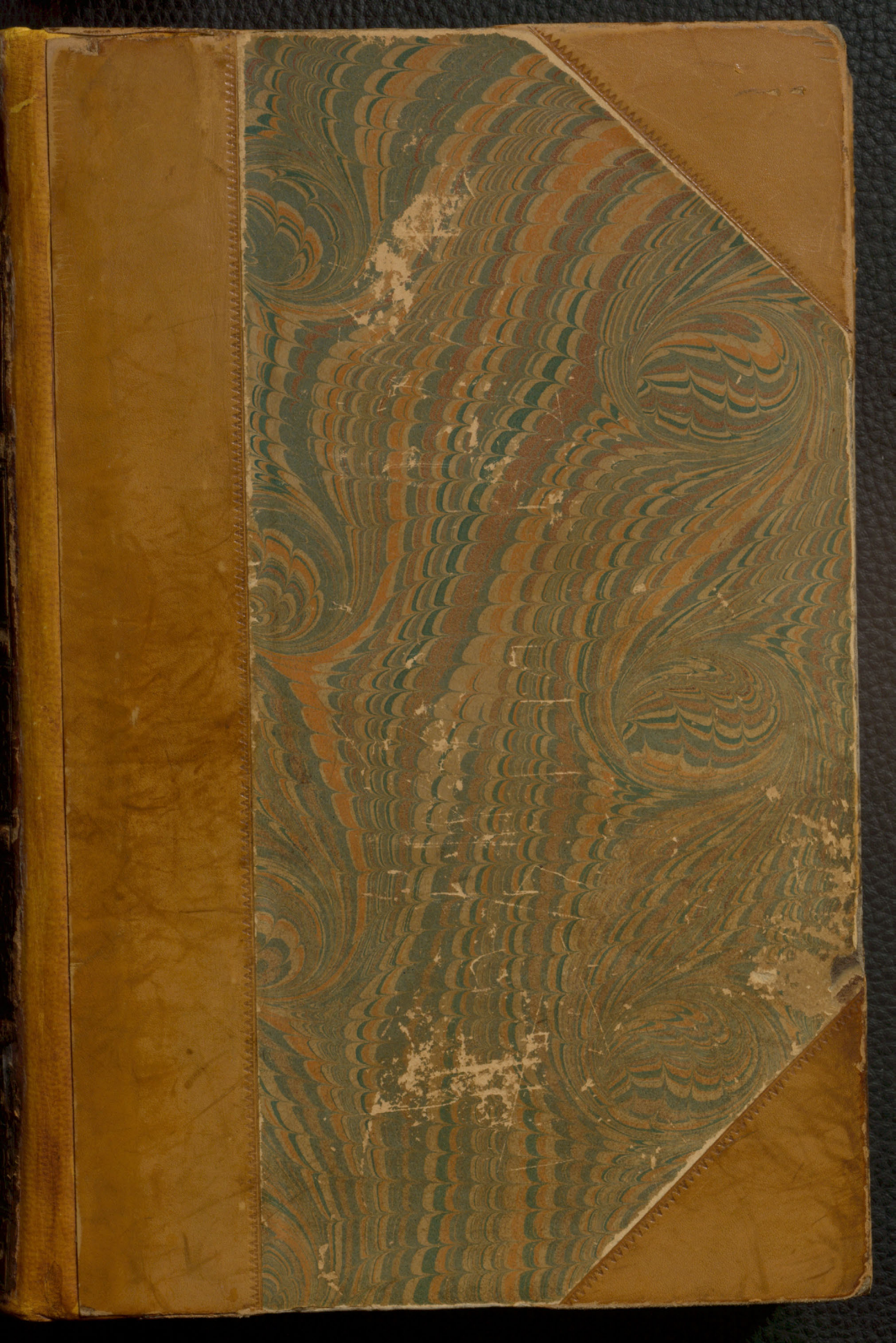


applicable in cases of abscess of the kidney. Under these conditions the kidney would supposedly be fixed and not easily separated from its connective-tissue bed. Moreover, it would be enlarged, and in addition to this there would be the risk of rupturing the pus-sac, perhaps into the peritoneal cavity.

Akromegaly.—At a recent meeting of the Manchester Medical Society, DRESCHFELD (*British Medical Journal*, No. 1716, p. 1107) presented a man, thirty years old, who five years before began to display symptoms of akromegaly. The bones of the face and skull were enlarged, especially the lower jaw; the hands and feet showed the characteristic thickening and enlargement, and the bones of the forearm and the clavicles likewise to some extent. There was atrophy of both optic discs, with complete blindness of one eye and diminished vision of the other without hemianopsia. The thyroid

From Dr Huntington Williams
N.Y. State Dept. of Health
Albany.
2. X. 29.

This is still, of course, the 1st (1892) edition, though dated 1893. The publisher had the horrible habit of altering the date when printing off a new batch of copies.

W. W. F.

SIR WILLIAM OSLER, BART.
OXFORD

Dr. William Osler, of McGill University, Montreal, is prominently and favorably mentioned in connection with the Professorship of Clinical Medicine in the University of Pennsylvania, rendered vacant by the transfer of Dr. Pepper to the Chair of Theory and Practice of Medicine. Dr. Osler is widely known as a talented scholar, a learned clinician, and a popular teacher, and his election, which

Dr Osler

to the Montreal General Hospital, and in 1878, Physician and Lecturer on Clinical Medicine in the Summer Session. He was elected a Fellow of the Royal College of Physicians of London, in 1883, and has been appointed to deliver the next Gulstonian Course of Lectures before that body. His contributions to medical literature are numerous and valuable; they cover the broad field of medicine and bear evidence of being the fruits of a cultivated and scholarly mind. At the annual meeting of the Canada Medical Association, held last month, in view of his anticipated removal to Philadelphia, and actuated by a strong desire on the part of its members to testify their high regard for his ability and charac- elected President for the ensuing year.

brief sketch it will be perceived that Dr. to Philadelphia in the early maturity of al powers, with a mind well trained for he called upon to perform, and in the enjoy- his own home and abroad, of a deservedly al and professional reputation, which has d at an unusually early period in his career. ersity of Pennsylvania and the medical f the States are to be congratulated on this d while Dr. Osler leaves Montreal amid and expressed regrets of the faculty and McGill College, of the medical profession medical press of Canada, a most cordial aits him at Philadelphia, in his new and eld of labor.

SPECIAL ARTICLE.

NEW TESTS FOR ACETONE—ACETONÆMIA.

The complex of symptoms known as diabetic coma was first described by v. Dusch in 1857; shortly afterwards by Petters, Kaulich, and Cantoni—1857 to 1864—and has been more recently studied by Kussmaul, in 1874, and Frerichs, in 1883.

The symptoms are not invariably the same, but the presence of the condition is generally inferred if sleepiness and stupor, accompanied by frequent pulse, supervene upon the other symptoms of a monly gradual in their development, but there is sometimes met a more acute form, characterized by suddenness in the appearance of the above symptoms, to which are added gastric and intestinal dis-

J 31

MEDICAL NEWS

DR. WILLIAM OSLER.

LAST Tuesday Dr. William Osler, of Montreal, was unanimously elected to the Chair of Clinical Medicine in the University of Pennsylvania, rendered vacant by the transfer of Dr. Pepper to the Chair of Theory and Practice of Medicine.

Dr. Osler was born in 1849, and was educated at Trinity College School and at Trinity College, Toronto. He received his medical education at McGill College, Montreal, and at the Toronto School of Medicine, and the degree of Doctor of Medicine was conferred on him in 1872. He subsequently pursued his studies for two years and a half at University College, London, and at Berlin, and Vienna. In October, 1874, he was elected to the Chair of the Institutes of Medicine in McGill College. In the following year he was appointed Pathologist

Dr Osler





Summer of 1891 in one of Dr Robbs rooms
the Johns Hopkins Hospital where I worked ca
day ... from 8 am to 1 pm

M.D.

J. 3.1

received 1st copy This 24-1892
This one - 2nd reprint - April 16th 1892

Private copy.
May all the curses of the good Bishop Emeritus light on the borrower - and not - returner or abstracter - the stealer. of this book.

THE PRINCIPLES AND PRACTICE OF MEDICINE

DESIGNED FOR THE USE OF
PRACTITIONERS AND STUDENTS OF MEDICINE

This is the 2nd printing, with some of the errors corrected. The 1st printing of 3000 copies was distributed by March 17th, on which date I had to induce from Appleton & Co to stop corrections for 2nd printing

BY

WILLIAM OSLER, M. D.

FELLOW OF THE ROYAL COLLEGE OF PHYSICIANS, LONDON
PROFESSOR OF MEDICINE IN THE JOHNS HOPKINS UNIVERSITY AND
PHYSICIAN-IN-CHIEF TO THE JOHNS HOPKINS HOSPITAL, BALTIMORE
FORMERLY PROFESSOR OF THE INSTITUTES OF MEDICINE, MC GILL UNIVERSITY, MONTREAL
AND PROFESSOR OF CLINICAL MEDICINE
IN THE UNIVERSITY OF PENNSYLVANIA, PHILADELPHIA

For samples of good & bad pages of this 1st and 2nd edition

NEW YORK
D. APPLETON AND COMPANY
1892

pp. 601–38. Interleaved. Inserted: pr. cuttings and MS. notes. Bd. with no. 3541.

3541. Diseases of the Blood and Blood-Glandular System. la. 8°. [*Phila.*, 1885].

Extr. fr. Pepper's System of Pract. Med., iii, pp. 882–950. Interleaved. Inserted: MS. notes, and correspondence from Wm. Pepper, &c.

3542. The Cerebral Palsies of Children. A clinical study from the Infirmary for Nervous Diseases, Philadelphia. 8°. *Lond.*, 1889.

With figs. Inserted: a letter from Samuel Gee, and pr. extracts.

3543. The Principles and Practice of Medicine. Designed for the Use of Practitioners and Students of Medicine. la. 8°. *New York*, 1892.

With charts &c. 1st printing. Lady Osler's copy, with inscr. dated Phila., 25 Feb., 1892.

3544. *The same.* la. 8°. *New York*, 1892.

2nd printing. Interleaved copy, bd. in 2 vols., with numerous MS. notes, and insertions. The latter include a prospectus (endorsed: "This, thank the Lord, I did not write.") and 2 photos. of the author at work on the book. The following are among the notes:

PRIVATE COPY. May all the curses of the good Bishop Ernulphus light on the borrower-and-not-returner or upon the stealer of this book.

The 1st printing (1st copy received 24 Feb., 1892) of 3,000 copies was distributed by March 17th, on which date I had notice from Appleton & Co. to send corrections for a 2nd printing. This copy—2nd printing—was received 16 April, 1892. For samples of a good and a bad page of the MS. see at the end of this [1st] volume.

THE WRITING OF A TEXT-BOOK. 20. iii. 92.

On several occasions, in Philadelphia, I was asked by Lea Bros. to prepare a work on Diagnosis and had half promised one; indeed I had prepared a couple of chapters, but continually procrastinated on the plea that up to the 40th year a man was fit for better things than text-books. Time went on and as I crossed this date I began to feel that the energy and persistence necessary for the task were lacking. In Sept. 1890 I returned from a four-months trip in Europe, shook myself, and towards the end of the month began a work on Practice. I had nearly finished the chapter on Typhoid Fever when Dr. Granger, Messrs. Appleton's agent, came from N.Y. to ask me to prepare a Text-book on Medicine. We haggled for a few weeks about terms and finally, selling my brains to the Devil, I signed the contract. My intention had been to publish the work myself and have Lippincott or Blakiston (both of whom offered) handle the book, but the bait of a guaranteed circulation of 10,000 copies in two years and fifteen hundred dollars on the date of publication was too glittering, and I was hooked.

October, November, and December were not very satisfactory months and Jan. 1st, 1891, saw the infectious diseases scarcely completed. I then got well into harness. Three mornings of each

P.T.O.

The writing of a Text-book. III. 2. 92.

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months of '91 were devoted to proof reading. In January I made out the index and in the entire work nothing so wearied me as the verifying every reference. Without the help of Lafleur & Thayer who took the wards off my hands I never could have finished in so short a time; my other assistants also rendered much aid in looking up references & special points. During the writing of the work I lost only one afternoon thro. transient indisposition and never a nights' rest. Between Sept 1890 and Jan 1892 I gained nearly 8 lbs in weight

TO
THE MEMORY OF MY TEACHERS:

WILLIAM ARTHUR JOHNSON,
PRIEST OF THE PARISH OF WESTON, ONTARIO.

JAMES BOVELL,
OF THE TORONTO SCHOOL OF MEDICINE,
AND OF THE
UNIVERSITY OF TRINITY COLLEGE, TORONTO.

ROBERT PALMER HOWARD,
DEAN OF THE MEDICAL FACULTY AND PROFESSOR OF MEDICINE
McGILL UNIVERSITY, MONTREAL.

Preface to the second edition

I have to thank many friends, ~~too numerous to mention for~~ many corrections and suggestions. I am under special obligations to ~~my colleague~~ Dr Welch, to Dr Flexner & Dr H M Thomas a & Dr Thayer for much assistance; & to Professor Welch & Dr Flexner for advice & counsel.

I have made a fairly full revision of the work, having rewritten several sections, carefully corrected all & added here & there many fresh details

~~And lastly I have~~ My warmest thanks are due to the profession at large for their reception of the first edition

Much new matter has been added on Typhoid fever, the sections on Diphtheria, Affections of Malaria, the introduction to the nervous system, & I have be rewritten; and in the latter entirely new cuts have been prepared. New sections ~~other additions~~ are to be found on the Bubonic plague, Foot & Mouth Disease, Infantile scurvy, the hæmorrhagic Disorders of Infants, cystoma of the lungs, Leukophlegmasia, diseases of the Mesentery, Displacements, ~~of the~~ Adenoid deformities of the liver, the forms of localized Peritonitis, the treatment of Myxœdema, Anuria, ~~on the visceral neuralgias~~, Nicotine disease, Osteo-pulmonary Arthropathy, Hæmoglobinuria, parasitic infusoria, cerebral hæmorrhage, Graves' disease, ~~Spinal~~ Syphilitic myelitis, the new views on Tabes

In the section on parasites I have had the advantage of the wise counsel of Dr Stiles of the Bureau of Animal Industry, who has revised the nomenclature in accordance with the International

The Pines
Ballston
July 1st 1895

NOTE.

My thanks are due to my former first assistant, H. A. Lafleur, for much help, direct and indirect; to his successor, ~~W. S. Thayer,~~ for assistance in the section on Blood Diseases and for the preparation of the illustrative charts; to D. Meredith Reese, for the statistics on tuberculosis; to H. M. Thomas, for many suggestions in the section on Nervous Diseases, and particularly in the section on Topical Diagnosis; to L. P. Powell, of the Johns Hopkins University Library, for a careful revision of the manuscript; and to Miss B. O. Humpton, for valuable aid, especially in the preparation of the index.

JOHNS HOPKINS HOSPITAL,
BALTIMORE, *January 1, 1892.*

"Experience is fallacious and judgment difficult."

HIPPOCRATES: *Aphorisms, I.*

"And I said of medicine, that this is an art which considers the constitution of the patient, and has principles of action and reasons in each case."

PLATO: *Gorgias.*

(From W. S. OLIVER – see over →)

127 South Park Street,

Halifax, N. S.,

189

Physical Diagnosis of
Thoracic Aneurism

As the diagnosis of thoracic
aneurism of the Aorta is often
difficult & obscure × × × ×
I am desirous of submitting
a Method of Examination, which
has afforded me Material Assistance
in diagnosing this disease (or
even simple dilatation of the
Vessel) when it occurs, & is most
frequently the case, in the Ascending,
or the first part of the Transverse

Position of the Arch —

The Process is as follows —

Place the patient in the Erect position, and direct him to close his mouth and Elevate his chin to almost the full Extent; the Operator then finds the Cricoid Cartilage between the fingers and thumb, and use steady gentle upward pressure on it, when if dilatation or Aneurism Exist, the Pulsations of the Aorta will be distinctly

felt transmitted through
the trachea to the hand."
"The act of Examination
will increase laryngeal
distress should the
accompany the disease."
Lancet 21 Sept 1878 –
Written by me 13 Sept 1878

= W.S. Oliver surgeon, Hexham
Lancet, 1878, ii, p. 406 (not under
"Correspondence") 4, 47, 1947.
(1835–1908) "Inventor of the military
equipment [what?]" d. at Hexham his name"
(Johnston, Roll (#5996) ends 5599, p. 401.
Recorded, inherited, but less adaptable than K bolt equipment

General & local infections :—

The toxic conditions.

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* The red shows the temperature, the black the morning and evening temperature.

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* The red shows the two-hourly, the black the morning and evening temperature.

Essay on Fevers had "taken notice of the very great difference there is between the putrid malignant ~~fevers~~ and the slow nervous fever"

A TEXT-BOOK ON THE PRACTICE OF MEDICINE.

SECTION I.

SPECIFIC INFECTIOUS DISEASES.

I. TYPHOID FEVER.

Definition.—An infectious disease, characterized anatomically by hyperplasia and ulceration of the lymph-follicles of the intestines, swelling of the mesenteric glands and spleen, and parenchymatous changes in the other organs. The bacillus of Eberth is constantly present in the lesions. Clinically the disease is marked by fever, a rose-colored eruption, diarrhœa, abdominal tenderness, tympanites, and enlargement of the spleen; but these symptoms are extremely inconstant, and even the fever varies in its characters.

Historical Note.—The dates 1813 and 1850 include the modern discussion of the subject. Prior to the former year many observers had noted clinical differences in the continued fevers. Huxham in particular, in his remarkable essay, had recognized varieties. In 1813 Pierre Bretonneau, of Tours, distinguished "dothiénentérite" as a separate disease; and Petit and Serres described entero-mesenteric fever. Trousseau and Velpeau, students of Bretonneau, were, in 1820, instrumental in making his views known to Andral and others in Paris. In 1829 Louis' great work appeared, in which the name "typhoid" was given to the fever. At this period typhoid fever alone prevailed in Paris, and it was universally believed to be identical with the continued fever of Great Britain, where in reality typhoid and typhus coexisted, and the intestinal lesion was regarded as an accidental occurrence in the course of ordinary typhus. Louis' students returning to their homes in different countries had opportunities of studying the prevalent fevers in the thorough and systematic manner of their master. Among these were certain young American physicians, to one of whom, Gerhard, of Philadelphia, is due the great honor of having first clearly laid down the differences between the two diseases. His papers in the American Journal of the Medical Sciences are undoubtedly the first in any language which give a full and

7 1857

satisfactory account of the clinical and anatomical distinctions we now recognize. No student should fail to read these articles, among the most classical in American medical literature.

Louis' influence was early felt in Boston, to which, in 1833, James Jackson, Jr., had returned from Paris. In this year he demonstrated, in his father's wards at the Massachusetts General Hospital, the identity of the typhus of this country with the typhoid of Louis. He had already, in 1830, noticed the intestinal lesions in the common fever of New England. Though cut off at the very outset of his career, we may reasonably attribute to his inspiration the two elaborate memoirs on typhoid fever which, in 1838 and 1839, were issued from the Massachusetts General Hospital, by James Jackson, Sr., and Enoch Hale. These, with Gerhard's articles, contributed to make typhoid fever, as distinguished from typhus, widely recognized in the profession here long before the distinctions were recognized generally in Europe. Thus, the ~~diseases~~ were described ~~under different headings~~ in the first edition of Bartlett's admirable work on Fevers published in 1842.

The recognition in Paris of a fever distinct from typhoid, without intestinal lesions, was due largely to the influence of the able papers of George C. Shattuck, of Boston, and Alfred Stillé, of Philadelphia, which were read before the Société médicale d'Observation in 1838. At Louis' request, Shattuck went to the London Fever Hospital to study the disease in England, where he saw the two distinct affections, and brought back a report which was very convincing to the members of the society.

Stillé had the advantage of going to Paris knowing thoroughly the clinical features of typhus fever, for he had been Gerhard's house-physician at the Philadelphia Hospital, where he had studied during the epidemic of 1836. At La Pitié, with Louis, he saw quite a different affection, while in London, Dublin, and Naples he recognized typhus as he had seen it in Philadelphia. The results of his observation were given in an exhaustive paper which presented in tabular form the contrasts and distinctions, clinical and anatomical, which we now recognize.

In Great Britain the non-identity of typhus and typhoid was clearly established at Glasgow, where from 1836 to 1838 A. P. Stewart studied the continued fevers, and in 1840 published the results of his observations. In the decade which followed many important works were issued and more correct views gradually prevailed; but it was not until the publication of Jenner's observations between 1849 and 1851 that the question was finally settled in England.

Etiology.—Typhoid fever prevails especially in temperate climates, in which it constitutes the most common continued fever. Widely distributed throughout all parts of the United States and Canada, it probably presents everywhere the same essential character.

It prevails most in the autumn months. Of 1,889 cases admitted to the Montreal General Hospital in twenty years, more than fifty per cent

Phila. June 8th 1893.

Dear Doctor Osler.

Your questions at the meeting of the College induced me to put in order the facts of the case, - which are these. Dr Gerhard returning from Europe in 1834 was made a Resident Phys. Pen. Hosp., & had a private class whom he instructed in clinical med. Typhoid fever interested him peculiarly. ~~I have afterwards proved~~ owing to his study of it in Paris under Louis; & this typhus which he had also observed in Edinburgh. In 1836 there was an epidemic of typhus at Blockley, where I was then a Resident Physician, & studied it under Gerhard, & became interested in the question of the specific differences of the two diseases. This induced a what knowledge of the matter I possessed, I went to Paris, & in Sept. 1838 I presented to the Soc. Med. d'Obs. a paper of which you have seen a copy & which ~~I showed~~ pointed out point by point the analogies & contrasts of the two diseases. It was in Feb. 1839 (according to Marchison) that Dr Chatto ~~studied~~ studied typhus & typhoid fever at the London Fever Hospital &

of fever 1842.

pointed out their distinctive characters
from. In the same year Shattuck com-
mitted his notes to Vallerix who published
an analysis of them in the Archives gén. for
Jan. & Feb. 1839; Grisolle relates the
same history in his Pathologie Interne
2ème éd., 1846. p. 65.

un grand d

I think these were the points upon
which I could not definitely inform
you last evening.

Yours very sincerely,

Alfred Stillé

Rogers N.Y. Med Record 1894 Jul

Typhoid in Infancy

^ Typhoid fever has been ~~prevalent~~ diminishing steadily in the great cities
~~wall~~ ~~Pa~~ ~~State~~ ~~sanitary~~ ~~developments~~ ~~H~~ owing + unperfected sanitary
Ne New York during the disease prevailed much more widely
small towns + country districts than in the larger cities

were in the months of August, September, and October. Of 1,381 cases treated during twelve years at the Toronto General Hospital, 761 occurred in these months (Graham). It has been well called the autumnal fever.

It has been observed to prevail most in hot and dry seasons. According to Pettenkofer, epidemics are most common when the ground-water is low, under which circumstances the springs and water-sources drain more thoroughly contaminated foci and are more likely to be highly charged with poison. It may be also, as Baumgarten suggests, that in dry seasons the poison is more disseminated by the dust.

Males and females are about equally liable to the disease, but males with typhoid are much more frequently admitted into hospitals.

Typhoid fever is a disease of youth and early adult life. The greatest susceptibility is between the ages of fifteen and twenty-five. Of 660 of the Montreal cases there were under fifteen years of age, 51; between fifteen and twenty-five years, 308; between twenty-five and thirty-five years, 153; between thirty-five and forty-five years, 43; between forty-five and fifty-five years, 6; and over fifty-five years, 9. Cases are rare over sixty. It is not very infrequent in childhood, but infants are rarely attacked. Murchison has seen a case at the sixth month. It is stated that the disease may be congenital in cases in which the mother has had the disease late in pregnancy.

As in other fevers, not all exposed to the infection take the disease, and there are grades of susceptibility. Some families seem more disposed to infection than others.

The Specific Germ.—The researches of Eberth, Koch, Gaffky, and others have shown that there is a special micro-organism *constantly* associated with typhoid fever. It is a rather short, thick, motile bacillus, with rounded ends, in one of which, sometimes in both (particularly in cultures), there can be seen a glistening round body, believed to be a spore; but these polar structures are probably only areas of dense protoplasm. It grows readily on various nutritive media, and on potato in a characteristic manner, as the growth is invisible. This feature is not peculiar however to the typhoid bacillus. It is difficult to differentiate from the *bacterium coli commune*, except by certain chemical tests. This organism fulfils two of the requirements of Koch's law—it is constantly present, and it grows outside the body in a specific manner. The third requirement, the production of the disease experimentally by the cultures, has not yet been met. Probably the animals used for experimentation are not susceptible to typhoid fever. The bacilli inoculated in large quantities into the blood of rabbits are pathogenic, and in some instances ulcerative and necrotic lesions in the intestine may be produced. But similar intestinal lesions may be caused by other bacteria, including the *bacterium coli commune.*

The bacilli produce various poisons, of which Brieger has described a ptomaine—typhotoxin, and Brieger and Fränkel a toxalbumin; but our

information on these substances is still very defective. Cultures are killed at a temperature of 60° C. It is not probable that the typhoid bacillus produces spores, but it resists drying for days. Bouillon cultures are destroyed by carbolic acid, 1 to 200, and by corrosive sublimate, 1 to 2,500.

In recent cases of typhoid fever the bacillus is found in the lymphoid tissues of the intestines, in the mesenteric glands, in the spleen, and in the liver. It occurs also in irregular clumps in the contents of the intestines and in the stools. The bacillus is said to have been found rarely in the blood, in the rose-colored spots (?), and in the urine.

Outside the body the bacilli retain their vitality for weeks in water. Whether an increase can occur is not yet finally settled. Bolton denies it, but the general opinion seems to be that such increase may take place to some extent. They disappear from ordinary water in competition with saprophytes in a few days. In milk they undergo rapid development without changing the appearance of the milk. They may increase in the soil and retain their vitality for months. They are not killed by freezing, but, as Prudden has shown, may live in ice for months. In many epidemics the bacilli have been detected in the infected water. The detection however of the typhoid bacillus in drinking-water is by no means easy, and the question in individual cases must be settled by experts who have had special experience with this germ. Both Prudden and Ernst have found it in water-filters.

Modes of Conveyance.—(*a*) *Contagion.*—Typhoid fever is certainly not a very contagious disease, but the possibility of direct transmission must be acknowledged. The poison is not given off from the skin or in the breath, but in the fæces. Practically only those persons are liable to contract the disease in this way who have to do with the stools or with the body-linen of patients. I have known several instances in which nurses appear to have been infected under these conditions.

(*b*) *Infection of water* is unquestionably the most common mode of conveyance. Many epidemics have been shown to originate in the contamination of a well or a spring. A very striking one occurred at Plymouth, Pa., in 1885, which was investigated by Shakespeare. The town, with a population of eight thousand, was in part supplied with drinking-water from a reservoir fed by a mountain stream. During January, February, and March, in a cottage by the side of, and at a distance of from sixty to eighty feet from, this stream, a man was ill with typhoid fever. The attendants were in the habit at night of throwing out the evacuations on the ground toward the stream. During these months the ground was frozen and covered with snow. In the latter part of March and early in April there was considerable rainfall and a thaw, in which a large part of the three months' accumulation of discharges was washed into the brook, not sixty feet distant. At the very time of this thaw the patient had numerous and copious discharges. About the 10th of April cases of typhoid fever broke out in the town, appearing for a time at the rate of fifty a

In the stools the bacilli

occasionally &c

it may be present in numbers

and to a less extent in the urine

Food as a source. Munich epidemic

Oysters may be ~~contaminated~~ infected during the process of fattening or freshening. In the Middlebury epidemic reported by H W Conn the chain of circumstantial evidence is fairly complete, and several short suggestive sporadic cases have been recorded by Sir Wm Broadbent. The ordinary salt-water oyster grows under conditions which are not favorable to the typhoid bacilli but when removed to fresh or brackish water to fatten or when preserved on bad ice they may become contaminated.

Products of the growth

Are the enteric lesions constant and specific? ~~Almost~~ ~~universally acknowledged that~~ In an immense majority of all cases the Peyer's glands are involved. It is claimed that the disease may exceptionally exist without lesions? these structures. (Karlinski - Wiener medicin. Wochenschr., March. 14, 21—1891. —— Du Cazal - Soc. med. des Hôp., April 7-1893. — Rev. des Sci. med. No. 85, p. 172). In Du Cazal's case rose spots and all the characteristic features of the disease were present - and the patient died of pneumonia on the 15th day. The spleen was enlarged - but the intestines and mesenteric glands were uninvolved. Typhoid bacilli were separated from the spleen in pure cultures.

day. In all about twelve hundred people were affected. An immense majority of all the cases were in the part of the town which received water from the infected reservoir.

Milk also may be the source of infection. One of the most thoroughly studied epidemics due to this cause was that investigated by Ballard in Islington. The milk may be contaminated by infected water used in cleansing the cans. In fresh milk it has been shown that the germs grow rapidly.

Filth, bad sewers, or cesspools can not in themselves cause typhoid fever, but they furnish the conditions suitable for the preservation of the bacillus and possibly for its propagation.

(*c*) *Contamination of the Soil.*—Pettenkofer holds that the poison is not eliminated in a condition capable of communicating the disease directly, but that it must first undergo changes in the soil, which changes are favored by the ground-water.

It does not seem probable that typhoid fever is communicated by the air alone, as by the medium of sewer-gas.

Once in the intestinal canal the typhoid germs probably do not, like the cholera bacilli, increase in the secretions, but penetrate the epithelial lining and reach the lymphoid tissue, upon which they exert their specific action, causing a cell proliferation greatly in excess of the physiological process. The necrosis may be regarded as the result of the maximum intensity of the action of the bacilli—an action not confined to the lymphatic apparatus of the intestinal wall, but also met with in a typical manner in the enlarged mesenteric glands and in the liver and spleen.

It has not yet been definitely determined whether the constitutional disturbances in typhoid fever depend upon the toxalbumins produced in the growth of the bacilli, though this is in the highest degree probable.

Morbid Anatomy.—The statistical details under this heading are based upon sixty-four autopsies, a majority of which were performed at the Montreal General Hospital, and upon the records of two thousand post-mortems at the Munich Pathological Institute.*

Intestines.—A catarrhal condition exists throughout the small and large bowel, and to this is due, in all probability, the diarrhœa with the thin pea-soup-like stools. Associated with this catarrh there is during life some epithelial desquamation.

Specific changes occur in the lymphoid elements of the bowel, chiefly at the lower end of the ileum. The alterations which occur are most conveniently described in four stages:

1. *Hyperplasia*, which involves the glands of Peyer in the jejunum and ileum, and to a variable extent those in the large intestine. The follicles are swollen, grayish-white in color, and the patches may project to a distance of from three to five mm. In exceptional cases they may be still more

* Münchener medicinische Wochenschrift, Nos. 3 and 4, 1891.

prominent. The solitary glands, which range in size from a pin's head to a large pea, are usually deeply imbedded in the submucosa, but project to a variable extent. Occasionally they are very prominent and may be almost pedunculated. Microscopical examination shows at the outset a condition of hyperæmia of the follicles. Later there is a great increase and accumulation of cells of the lymph-tissue which may even infiltrate the adjacent mucosa and the muscularis; and the blood-vessels are more or less compressed, which gives the whitish anæmic appearance to the follicles. The cells have all the characters of ordinary lymph-corpuscles. Some of them however are larger, epithelioid, and contain several nuclei. Occasionally cells containing red blood-corpuscles are seen. This so-called medullary infiltration, which is always more intense toward the lower end of the ileum, reaches its height from the eighth to the tenth day and then undergoes one of two changes, *resolution* or *necrosis*. Death very rarely takes place at this stage. I have seen but one instance in my series—a girl, aged twenty-four, who died at the end of the first week with severe nervous symptoms and in whose ileum the lymph-follicles were greatly swollen, pitted and cribriform, but without necrosis. Resolution is accomplished by a fatty and granular change in the cells, which are destroyed and absorbed. A curious condition of the patches is produced at this stage, in which they have a reticulated appearance, the *plaques à surface réticulée*. The swollen follicles in the patch undergo resolution and shrink more rapidly than the surrounding framework, or what is more probable the follicles alone owing to the intense hyperplasia become necrotic and disintegrate leaving the little pits. In this process superficial hæmorrhages may result and small ulcers may originate by the fusion of these superficial losses of substance.

There is nothing distinctive in the hyperplasia of the lymph-follicles in typhoid fever. Apart from this disease we rarely see in adults a marked affection of these glands with fever. In children however it is not uncommon when death has occurred from intestinal affections. It is also met with in measles, diphtheria, and scarlet fever.

2. *Necrosis and Sloughing.*—When the hyperplasia of the lymph-follicles reaches a certain grade resolution is no longer possible. The blood-vessels become choked, there is a condition of anæmic necrosis, and sloughs form which must be separated and thrown off. The necrosis is probably due in great part to the direct action of the bacilli. The process may be superficial, affecting only the upper part of the mucous coat, or it may extend to and involve the submucosa. It is always more intense toward the ileo-cæcal valve, and in very severe cases the greater part of the mucosa of the last foot of the ileum may be converted into a brownish-black eschar. The necrosis in the solitary glands forms a yellowish cap which often involves only the most prominent point of a follicle. The extent to which the necrosis reaches is very variable. It may pass deep into the muscular coat reaching to or even perforating the peritonæum.

3. *Ulceration.*—The separation of the necrotic tissue—the sloughing—is gradually effected from the edges inward, and results in the formation of an ulcer, the size and extent of which are directly proportionate to the amount of necrosis. If this be superficial, the entire thickness of the mucosa may not be involved and the loss of substance may be small and shallow. More commonly the slough in separating exposes the submucosa and muscularis, particularly the latter, which forms the floor of a majority of all typhoid ulcers. It is not common for an entire Peyer's patch to slough away, and a perfectly ovoid ulcer opposite to the mesentery is rarely seen. Irregularly oval and rounded forms are most common. A large patch may present three or four ulcers divided by septa of mucous membrane. The terminal six or eight inches of the mucous membrane of the ileum may form a large ulcer, in which are here and there islands of mucosa. The edges of the ulcer are usually swollen, soft, sometimes congested, and often undermined. At a late period the ulcers near the valve may have very irregular sinuous borders. The base of a typhoid ulcer is smooth and clean, usually formed of the submucosa or of the muscularis.

There may be large ulcers near the valve and swollen hyperæmic patches of Peyer in the upper part of the ileum.

4. *Healing.*—This begins with the development of a thin granulation tissue which covers the base and gives to it a soft, shining appearance. The mucosa gradually extends from the edge, and a new growth of epithelium is formed. The glandular elements are reformed; the healed ulcer is somewhat depressed and is usually pigmented. Occasionally an appearance is seen as if an ulcer had healed in one place and was extending in another. In death during relapse healing ulcers may be seen in some patches with fresh ulcers in others.

We may say, indeed, that healing begins with the separation of the sloughs, as, when resolution is impossible, the removal of the necrosed part is the first step in the process of repair. Practically, in fatal cases, we seldom meet with evidences of cicatrization, as the majority of deaths occur before this stage is reached.

Large Intestine.—The cæcum and colon are affected in about one third of the cases (in nineteen of the sixty-four). Sometimes the solitary glands are greatly enlarged. The ulcers are usually larger in the cæcum than in the colon. Perforation of the cæcum is rare. The appendix may be involved. In my cases there was ulceration in two and perforation in one case. I dissected a case in Montreal in which the patient died three months after an attack of typhoid fever, and a localized abscess was found, due to perforation of the appendix. Death resulted from pylephlebitis.

Perforation of the Bowel.—In one hundred and fourteen cases of the two thousand Munich autopsies (5·7 per cent) and in fourteen instances in my series, the intestine was perforated and death caused by peritonitis. The perforation may occur in ulcers from which the sloughs have already

separated, or it may be directly due to the extension of a necrosis through all the coats. In only a few cases is the perforation at the bottom of a clean thin-walled ulcer. In one instance the perforation occurred two weeks after the temperature had become normal. The sloughs were, as a rule, adherent about the site of perforation. A majority of the cases were in small deep ulcers. There may be two or even three perforations. The orifice is usually within the last foot of the ileum. In only one of my cases was it distant eighteen inches. Peritonitis was present in every instance.

Hæmorrhage from the bowels occurred in ninety-nine of the Munich cases, and in nine of my series. The bleeding seems to result directly from the separation of the sloughs. I was not able in any instance to find the bleeding vessel. In one case only a single patch had sloughed, and a firm clot was adherent to it. The bleeding may also come from the soft swollen edges of the patch.

The *mesenteric glands* at first show intense hyperæmia and subsequently become greatly swollen. Spots of necrosis are common. In several of my cases suppuration had occurred. The bunch of glands in the mesentery, at the lower end of the ileum, is especially involved. The retroperitoneal glands are also swollen.

The *spleen* is invariably enlarged in the early stages of the disease. In only one of my cases did it exceed (600 grammes) 20 ounces in weight. The tissue is soft, even diffluent. Infarction is not infrequent. Rupture may occur spontaneously or as a result of injury. In the Munich autopsies there were five instances of rupture of the spleen, one of which resulted from a gangrenous abscess.

The *liver* shows signs of parenchymatous degeneration. Early in the disease it is hyperæmic, and in a majority of instances it is swollen, somewhat pale, on section turbid, and microscopically the cells are very granular and loaded with fat. Necrotic areas occur in many cases, as described by Handford. They have been studied recently by Reed in Welch's laboratory. No definite association could be determined between the groups of bacilli and the necrotic areas. In twelve of the Munich autopsies liver abscess was found, and in three, acute yellow atrophy. Diphtheritic inflammation of the gall-bladder is occasionally met with. This may lead to perforation and fatal peritonitis.

The *kidneys* show cloudy swelling, with granular degeneration of the cells of the convoluted tubules; less commonly an acute nephritis. A rare condition described by Rayer, Wagner, and others is the occurrence of numerous small areas infiltrated with round cells, which may have the appearance of lymphomata (Wagner), or may pass on to softening and suppuration, producing the so-called *miliary abscesses*. It is usually a late change. The bacilli have been found by some observers in these areas. The bacilli can be obtained by culture from the kidneys, and have been found in many instances in sections. They have also been found in

Sept 4/92 Case of perforation of the colon in Typhoid fever - see p m
book. 2nd.
Look up July. & March cases.

~~It may be in the colon.~~ Of 22 fatal cases at the Johns Hopkins Hospital. 8 were due to perforation in two of these the appendix vermiformis & in the colon were the seat of the perforation.

Extensive ~~suppuration~~ abscess &c. in the mesentery may follow typhoid fever

Some of these nodules are lymphoid others are necrotic (amyot)

Perityphlitis is a ~~rare sequence~~ may follow abscess of the mesentery or perforation of the appendix

The typhosus bacilli alone may be found in the abscesses

James Bovd

Case of J. H. H. had extensive
laryngitis & tracheotomy

See Lennep. Archiv f. Klin. Chirurg. Bd XX XI

the urine in a few cases. Diphtheritic inflammation of the pelvis of the kidney may occur. It was present in three of my cases, in one of which the tips of the papulæ were also affected. Catarrh of the bladder is not uncommon. Diphtheritic inflammation of it may also occur. Orchitis is occasionally met with.

The anatomical changes in the *respiratory organs* are not very numerous. Ulceration of the larynx occurs in a certain number of cases; in the Munich series it was noted one hundred and seven times. It may come on at the same time as the ulceration in the ileum, but the bacilli have not yet, I believe, been found in the ulcers. They occur in the posterior wall, at the insertion of the cords, at the base of the epiglottis, and on the ary-epiglottidean folds. In the later periods catarrhal and diphtheritic ulcers may be present.

Œdema of the glottis was present in twenty of the Munich cases, in eight of which tracheotomy was performed. Diphtheritic laryngitis is not very uncommon. It occurred in a most extensive form in two of my cases. In one the membrane was chiefly in the pharynx, and extended only upon the epiglottis; in the other there was a uniform membrane which extended into the trachea and in the tubes of the second dimension. In eight cases in my series there was lobar pneumonia. Hypostatic congestion and the condition of the lung spoken of as splenization are very common. Gangrene of the lung occurred in forty cases in the Munich series; abscess of the lung in fourteen; hæmorrhagic infarction in one hundred and twenty-nine. Pleurisy is not a very common event. Fibrinous pleurisy occurred in about six per cent of the Munich cases, and empyema in nearly two per cent.

Changes in the Circulatory System.—Endocarditis is rare. It was not present in any of my cases, and existed in eleven only of the Munich autopsies, in which also there were fourteen cases of pericarditis. Myocarditis is not very infrequent. Dewevre,* in a series of forty-eight cases, found in sixteen granular or fatty degeneration, and in three a proliferating endarteritis in the small vessels. It is remarkable that even in cases of death from heart-failure, with intense fever, the cell-fibres may present little or no observable change. The *arteries* are not infrequently involved in typhoid fever. Barié distinguishes an acute obliterating arteritis and a partial arteritis, and states that they both occur most commonly in the arteries of the lower extremities. They are responsible, no doubt, for certain of the cases of blocking of the arterial trunks. This arteritis may affect the smaller vessels, particularly those of the heart. In the veins, thrombi are not infrequently found, particularly in the femoral veins, and more rarely in the cerebral sinuses.

Nervous System.—There are very few coarse changes met with. Meningitis is extremely rare. It was not present in any one of my autop-

* Archives générales de Médecine, 1887, 2.

sies, and occurred in only eleven of the two thousand Munich cases. The anatomical lesion upon which the aphasia—seen not infrequently in children—depends, is not known. Possibly, as Leyden states, it may be due to slight encephalitis. Parenchymatous changes have been met with in the peripheral nerves, and appear to be not very uncommon, even when there have been no symptoms of neuritis.

The voluntary muscles show, in certain instances, the peculiar changes described by Zenker which occur in all long-standing febrile affections and are not peculiar to typhoid fever. The muscle substance within the sarcolemma undergoes either a granular degeneration or a hyaline transformation. The abdominal muscles, the adductors of the thighs, and the pectorals are most commonly involved.

Symptoms.—In a disease so complex as typhoid fever it will be well first to give a general description and then to study more fully the sypmtoms, complications, and sequelæ according to the individual organs.

General Description.—The period of incubation lasts from a week to ten days, during which there are feelings of lassitude and inaptitude for work. The onset is rarely abrupt. There may be prodromal symptoms, either a rigor, which is rare, or chilly feelings, headache, nausea, loss of appetite, pains in the back and legs, and nose-bleeding. These symptoms increase in severity and the patient at last takes to his bed. From this event, in a majority of cases, the definite onset of the disease may be dated. During the *first week* there is, in some cases (but by no means in all, as has long been taught), a steady rise in the fever, the evening record rising a degree or a degree and a half higher each day, reaching 103° or 104°. The pulse is rapid, from 100 to 110, full in volume, but of low tension and often dicrotic; the tongue is coated and white; the abdomen is slightly distended and tender. Unless the fever is high there is no delirium, but the patient complains of headache, and there is mental confusion and wandering at night. The bowels may be constipated, or there may be two or three loose movements daily. Toward the end of the week the spleen becomes enlarged and the rash appears in the form of rose-colored spots, seen first on the skin of the abdomen. Cough and bronchitic symptoms are not uncommon at the outset.

In the *second week*, in cases of moderate severity, the symptoms become aggravated; the fever remains high and the morning remission is slight. The pulse is rapid and has lost its dicrotic character. There is no longer headache, but there is mental torpor and dulness. The face looks heavy; the lips are dry; the tongue, in severe cases, becomes dry also. The abdominal symptoms are more marked—diarrhœa, tympanites, and tenderness. Death may occur during this week, with pronounced nervous symptoms, or, toward the end of it, from hæmorrhage or perforation. In mild cases the fever declines, and by the fourteenth day may be normal.

In the *third week*, in cases of moderate severity, the pulse ranges from

The exudate may be either serous or purulent, and in both-
It may be either leptomeningitis serosa or pur-
typhoid bacilli have been demonstrated. (Tictine)
(arch f exper. med. 1/94

Rupture of the aorta has been
found post-mortem

from "Eight to
" fourteen days, sometimes twenty three" (clin soc.)

Typhoid septicaemia There are instances of the general infection of the body with the Eberth bacilli. The human blood serum as a rule rapidly kills the typhoid germ, but under certain conditions as yet unknown either increased virulence of the germ or diminished bactericidal power of the blood-serum — it multiplies in all the organs and in the blood constituting a veritable septicaemia. Such a case has recently been described in full by Hetzner. The intestinal lesions were slight. Until the development of paralytic ileus the symptoms pointed rather to cerebro-spinal meningitis. The temperature was low & irregular.

Rosen

and even the fifth

or of acute pleurisy -

110 to 130; the temperature now shows marked morning remissions, and there is a gradual decline in the fever. The loss of flesh is now more noticeable, and the weakness is pronounced. The diarrhœa and meteorism may persist. Unfavorable symptoms at this stage are the pulmonary complications, increasing feebleness of the heart, and pronounced delirium with muscular tremor. Special dangers are perforation and hæmorrhage.

With the *fourth week*, in a majority of instances, convalescence begins. The temperature gradually reaches the normal point, the diarrhœa stops, the tongue cleans, and the desire for food returns. In severe cases the fourth week may present an aggravated picture of the third; the patient grows weaker, the pulse is more rapid and feeble, the tongue dry, and the abdomen distended. He lies in a condition of profound stupor, with low muttering delirium and subsultus tendinum, and passes the fæces and urine involuntarily. Heart-failure and secondary complications are the chief dangers of this period.

In the *fifth and sixth weeks* protracted cases may still show irregular fever, and convalescence may not set in until after the fortieth day. In this period we meet with relapses in the milder forms or slight recrudescence of the fever. At this time, too, occur many of the complications and sequelæ.

Special Features and Symptoms.—*Mode of Onset.*—As a rule, the symptoms develop insidiously, and the patient is unable to fix definitely the time at which he began to feel ill. The following are the most important deviations from this common course:

(*a*) *Onset with Pronounced Nervous Manifestations.*—Headache, of a severe and intractable nature, is by no means an infrequent initial symptom. Again, a severe facial neuralgia may for a few days put the practitioner off his guard. In cases in which the patients have kept about and, as they say, fought the disease, the very first manifestations may be pronounced delirium. Such patients may even leave home and wander about for days. In rare cases the disease sets in with the most intense cerebro-spinal symptoms, simulating meningitis—severe headache, photophobia, retraction of the head, twitching of the muscles, and even convulsions. Occasionally drowsiness, stupor, and signs of basilar meningitis may exist for ten days or more before the characteristic symptoms develop; occasionally the onset is with mania.

(*b*) *With Pronounced Pulmonary Symptoms.*—The initial bronchial catarrh may be of great severity and disguise the other features of the disease. More striking still are those cases in which the disease sets in with a single chill, with pain in the side and all the characteristic features of lobar pneumonia.

(*c*) *With Intense Gastro-intestinal Symptoms.*—The vomiting may be incessant and uncontrollable. Occasionally there are cases with such intense vomiting and diarrhœa that a suspicion of poisoning may be aroused.

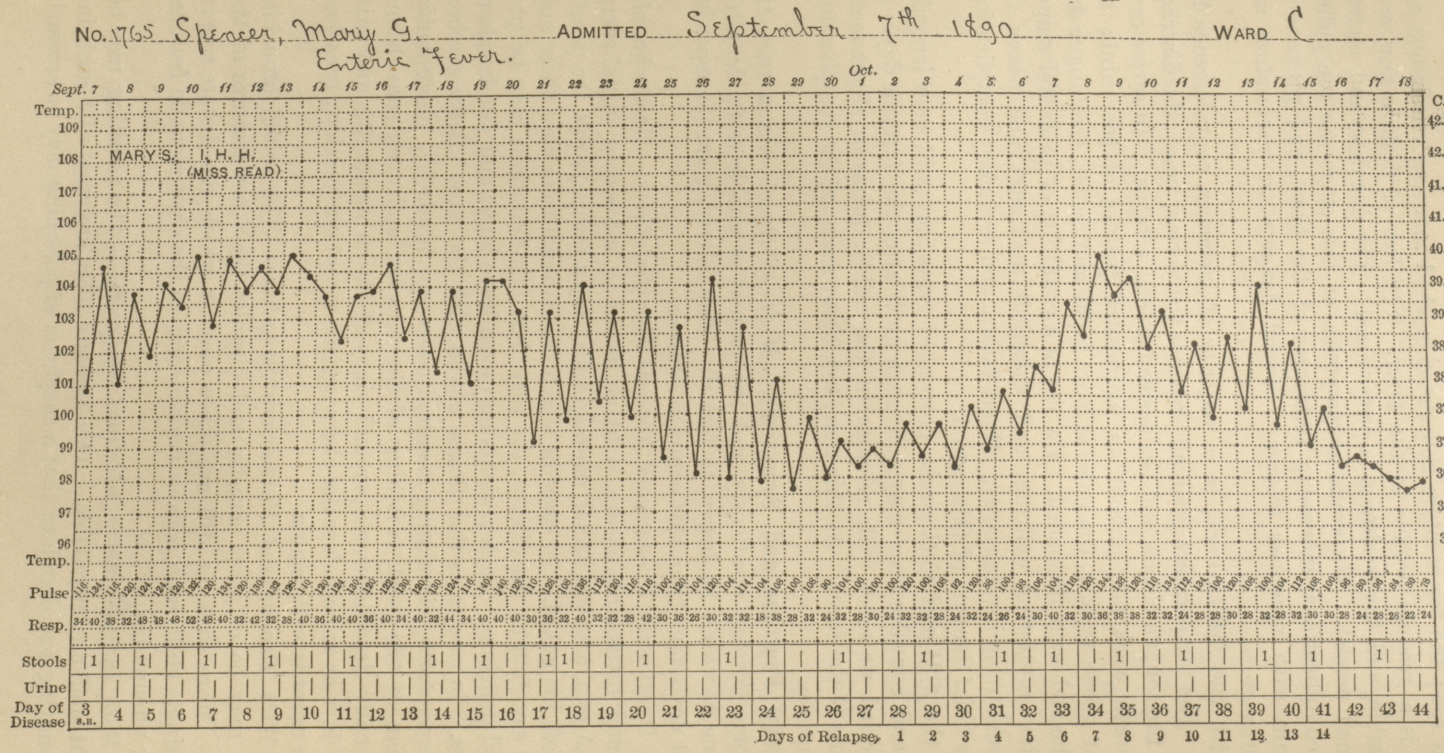


CHART I.—Typhoid Fever with relapse.

(*d*) *With Symptoms of an Acute Nephritis.*—Smoky or bloody urine, with much albumen and tube-casts.

(*e*) *Ambulatory Form.*—Deserving of especial mention are those cases of typhoid fever in which the patient keeps about and attempts to do work, or perhaps takes a long journey to his home. He may come under observation for the first time with a temperature of 104° or 105°, and the rash well out. Such cases seem always to run a more severe course than others, and in general hospitals they contribute largely to the total mortality. Finally, there are rare instances in which the first symptoms are perforation, or a profuse hæmorrhage from the bowels.

Facial Aspect.—Early in the disease the cheeks are flushed and the eyes bright. Toward the end of the first week the expression becomes more listless, and when the disease is well established the expression is dull and heavy. There is never the rapid anæmia of malarial fever.

Fever.—(*a*) *Regular Course.* (Chart I.)—In the stage of invasion the temperature may rise steadily during the first five or six days. The evening temperature is about a degree or a degree and a half higher than the morning remission, so that a temperature of 104° or 105° is not uncommon by the end of the first week. Having reached the fastigium or height, the fever then persists with slight morning remissions. The temperature curve follows the normal diurnal variations, the maximum occurring between four and eight o'clock in the evening and the minimum between four and eight in the morning. At the end of the second and throughout the third week the temperature becomes more distinctly remittent. The difference between the morning and evening may be three or four degrees, and the morning temperature may even be normal. It falls by gradual lysis, and the temperature is not considered normal until the evening record is at 98·2°.

(*b*) Variations in the normal temperature curve are common. We do not always see the gradual step-like ascent in the early stage; the cases do not often come under observation at this time. When the disease sets in with a chill, the temperature may rise at once to 103° or 104°. In many cases defervescence occurs at the end of the second week and the temperature may fall rapidly, reaching the normal within twelve or twenty hours. An inverse type of temperature, high in the morning and low in the evening, is occasionally seen but has no especial significance.

Sudden falls in the temperature may occur; thus, as shown in Chart IV, a drop of 10° may follow an intestinal hæmorrhage, and the fall may be very apparent even before the blood has appeared in the stools. Hyperpyrexia, temperature above 106°, is not very common in typhoid fever except just before death, when I have known the thermometer to register 109·5°. (Chart II.)

(*c*) *Post-Typhoid Elevations—Fever of Convalescence.*—During convalescence, after the temperature has been normal, perhaps for five or six days, the fever may rise suddenly to 102° or 103°, and, after per-

sisting for from one to three days or even longer, falls to normal. With this there is no constitutional disturbance, no furring of the tongue, no distention of the abdomen. These so-called recrudescences are by no means uncommon, and are of especial importance, as they cause great anxiety to the practitioner. They are attributed most frequently to errors in diet, constipation, emotions, and excitement of any sort, such as seeing friends.

There are cases in which the temperature declines almost to the normal at the end of the third week, the tongue cleans, and the patient enters

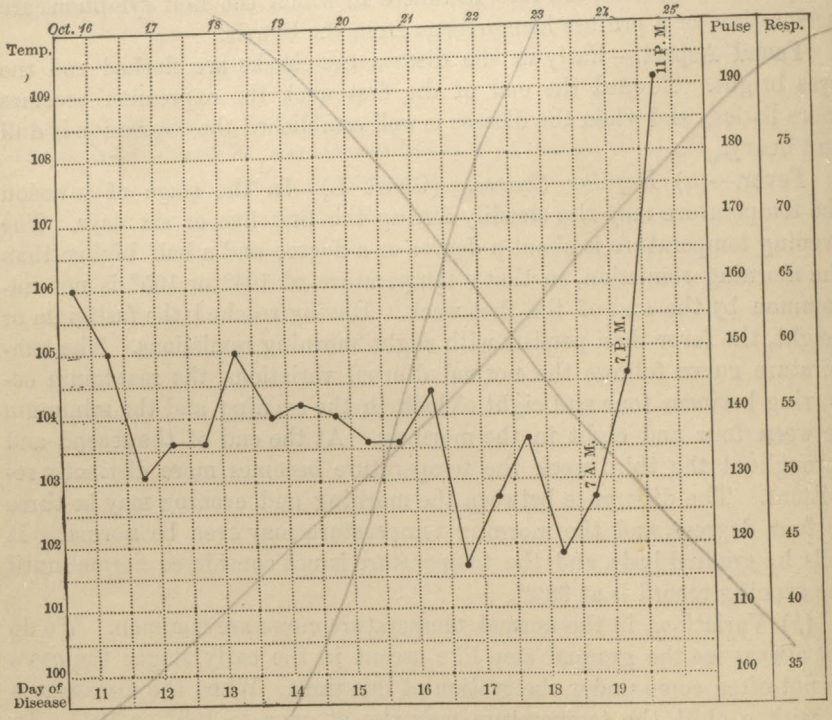


CHART II.—Hyperpyrexia—death.

apparently upon a satisfactory convalescence. The evening temperature, however, does not reach 98·5°, but constantly keeps about 99·5° or 100°, and occasionally rises to 100·5°. This, in the late stages of convalescence, I have seen due to the post-typhoid anæmia. Complications should be carefully looked for, particularly insidious pleurisy or bone lesions.

In certain of these cases the persistence of the fever seems to be really a nervous phenomenon, and there is nothing in the condition of the patient to cause uneasiness except the evening elevation of temperature. If the tongue is clean, the appetite good, and there are no intestinal symptoms, it may be disregarded. I have frequently found this condition best met by allowing the patient to get up and by stopping the use of the thermometer. This prolonged slight elevation of the fever after the dis-

7 chills in Typhoid Fever are occur (a) sometimes with the fever of onset; ~~not however with great frequency~~; (b) occasionally at intervals throughout the course of the disease & followed by sweats (so called sudoral form); (c) with the advent of complications, pleurisy, pneumonia, suppuration &c; (d) with active antipyretic treatment by the coal-tar remedies (I, occasionally during the period of defervescence without relation to any complication or sequel (see Brouardel ~~in Medical~~ also in Medical. 1882. (Lyons Am. 1883) probably due to septic infection. ~~with pus~~. There are cases in which through out the latter half of the disease chills recur with great severity.

appearance of all the symptoms is most common in children and in patients of marked nervous temperament.

(*d*) *The Fever of the Relapse.*—This is a repetition in many instances of the original fever, a gradual ascent and maintenance for a few days at a certain height and then a gradual decline. It is shorter than the original pyrexia, and rarely continues more than two or three weeks. (Chart I.)

(*e*) *Afebrile Typhoid.*—There are cases described in which the chief features of the disease have been present without the existence of fever. They are extremely rare in this country. No instance of the kind has come under my observation.

Skin.—The rash of typhoid fever is very characteristic. It consists of a number of rose-colored spots, which appear from the seventh to the tenth day, usually first upon the abdomen. The spots are flattened papules, slightly raised, of a rose-red color, disappearing on pressure, and ranging in diameter from two to four millimetres. They can be felt as distinct elevations on the skin. Sometimes each spot is capped by a small vesicle. The spots may be dark in color and occasionally become petechial. After persisting for two or three days they gradually disappear, leaving a brownish stain. They come out in successive crops, but rarely appear after the middle of the third week. They are present in the typical relapse. The rash is most abundant upon the abdomen and lower thoracic zone, and often abounds upon the back, ~~It is extremely variable in degree. There are cases in which it~~ spreads to the extremities ~~and often~~ to the face. I can not say that in my experience these cases with the more abundant eruption have been of specially severe type. The rash is not always present. Murchison states that it is frequently absent in children.

A branny desquamation is not rare in cases in which the sudaminal vesicles have been abundant; occasionally the skin may peel in large flakes.

The following accidental rashes are met with in typhoid fever:

1. *Erythema.*—It is not very uncommon in the first week of typhoid fever to find the skin of a vivid red color, almost like a scarlatinal rash. This is particularly noticeable on the abdomen and chest, but the rash may spread to the extremities. It may possibly in some instances, but certainly not always, be due to quinine. I have seen it much more frequently in the past five years (during which time I have rarely ordered a dose of quinine in this disease) than I did in Montreal, where we used quinine largely as an antipyretic.

2. The *tache bleuâtre—Peliomata.*—These are pale-blue spots, subcuticular, from 4 to 10 mm. in diameter, of irregular outline and most abundant about the chest, abdomen, and thighs. They sometimes give a very striking appearance to the skin. It can be readily seen that the injection is in the deeper tissues and not superficial. This rash is quite without significance. Since my attention was called to its association with

body lice, I have met with no instance in which these were not present. Several French observers maintain that they are due to the irritating effects of the fluid secreted by pediculi.

3. Sudaminal and miliary eruptions are common in all cases in which there is profuse sweating.

4. Urticaria is occasionally met with, and lastly herpes, but this is uncommon in comparison with its frequency in malaria and pneumonia.

The *tache cérébrale*, a red line with white borders, can be produced by drawing the nail over the skin. It is a vaso-motor phenomenon which, as in other fevers, can be readily elicited, particularly in nervous subjects. Here may be mentioned certain other cutaneous phenomena also of vaso-motor nature: thus exposure of the abdomen may be sufficient to cause a pinkish injection, which may in places change to an ivory white, giving a curious mottled appearance to the skin. A similar appearance may be seen on the arms. The general tint may be white, with irregular patches or streaks of pink or dark red.

Sweats.—At the height of the fever the skin is usually dry. Profuse sweating is rare, but it is not very uncommon to see the abdomen or chest moist with perspiration, particularly in the reaction which follows the bath. Sweats in some instances constitute a striking feature of the disease. They may occasionally be associated with chilly sensations or actual chills. Jaccoud and others in France have especially described this *sudoral* form of typhoid fever. There may be recurring paroxysms of chill, fever, and sweats (even several in twenty-four hours), and the case may be mistaken for one of intermittent fever. The fever toward the end of the second week and during the third week may be intermittent. The characteristic rash is usually present, and if absent the negative condition of the blood is sufficient to exclude malaria. I have seen cases of this form in Montreal, where there could have been no suspicion of malarial infection.

Œdema of the skin occurs:

1. As the result of vascular obstruction, most commonly of a vein, as in thrombosis of the femoral vein.

2. In connection with nephritis.

3. In association with the anæmia and cachexia.

The hair is very apt to fall out after an attack of typhoid fever. Instances of permanent baldness are of extreme rarity. As in other diseases associated with fever the nutrition of the nails suffers, and during and after convalescence a transverse ridge is seen.

~~And, lastly,~~ It is stated that a peculiar odor is exhaled from the skin in ~~typhoid fever~~. Whether due to a cutaneous exhalation or not, there certainly is a very distinctive smell connected with many patients. I have repeatedly had my attention directed to it by nurses. Nathan Smith describes it as of a "semi-cadaverous, musty character."

Circulatory System.—The *blood* presents important changes. The

following statements are based on studies which W. S. Thayer has made in my ward. During the first two weeks there may be little or no change in the blood. Profuse sweats or copious diarrhœa may, as Hayem has shown, cause the corpuscles—as in the collapse stage of cholera—to rise above normal. In the third week a fall usually takes place in corpuscles and hæmoglobin and the number may sink rapidly even to 1,300,000 per c. mm., gradually rising to normal during convalescence. When the patient first gets up, there may be a slight fall in the number of the corpuscles.

The amount of hæmoglobin is always reduced, and usually in a greater relative proportion than the number of red corpuscles, and during recovery the normal color standard is reached at a later period. The number of colorless corpuscles varies little from the normal standard (6,000 ± per c. mm.). As a rule, perhaps the number is slightly subnormal (Pée). This fact is important, and may be at times of real diagnostic value in distinguishing typhoid fever from various septic fevers and acute inflammatory processes in which there is leucocytosis.

The accompanying blood-chart shows these changes well.

The post-typhoid anæmia may reach an extreme grade. In one of my cases the blood-corpuscles sank to 1,300,000 per cubic mm. and the hæmoglobin to about twenty per cent. These severe grades of anæmia are not common in my experience. In the Munich statistics there were fifty-four cases with general and extreme anæmia.

Of changes in the blood plasma very little is known.

The *pulse* in typhoid fever presents no special characters. It is increased in rapidity in proportion to the height of the fever. As a rule, in the first week it is above 100, full in volume and often dicrotic. There is no acute disease with which, in the early stage, a dicrotic pulse is so frequently associated. Even with high fever the pulse may not be greatly accelerated. As the disease progresses the pulse becomes more rapid, feebler, and small. In the extreme prostration of severe cases it may reach 150 or more, and is a mere undulation—the so-called running pulse. The lowered arterial pressure is manifest in the dusky lividity of the skin and coldness of the hands and feet.

During convalescence the pulse gradually returns to normal, and occasionally becomes very slow. After no other acute fever do we so frequently meet with bradycardia. I have counted the pulse as low as thirty, and instances are on record of still fewer beats to the minute.

The *heart-sounds* are at first clear and loud, and free from murmur, but in severe cases, as the prostration develops, the first sound becomes feeble and there is often to be heard, at the apex and along the left sternal margin, a soft systolic murmur. The first sound may be gradually annihilated, as pointed out by Stokes. In the extreme feebleness of the ataxic forms, the first and second sound become very similar and the long pause is much shortened.

Of cardiac complications, *pericarditis* is rare and has been met with chiefly in children and in association with pneumonia. It was not present in any of my cases and occurred in only fourteen of the two thousand

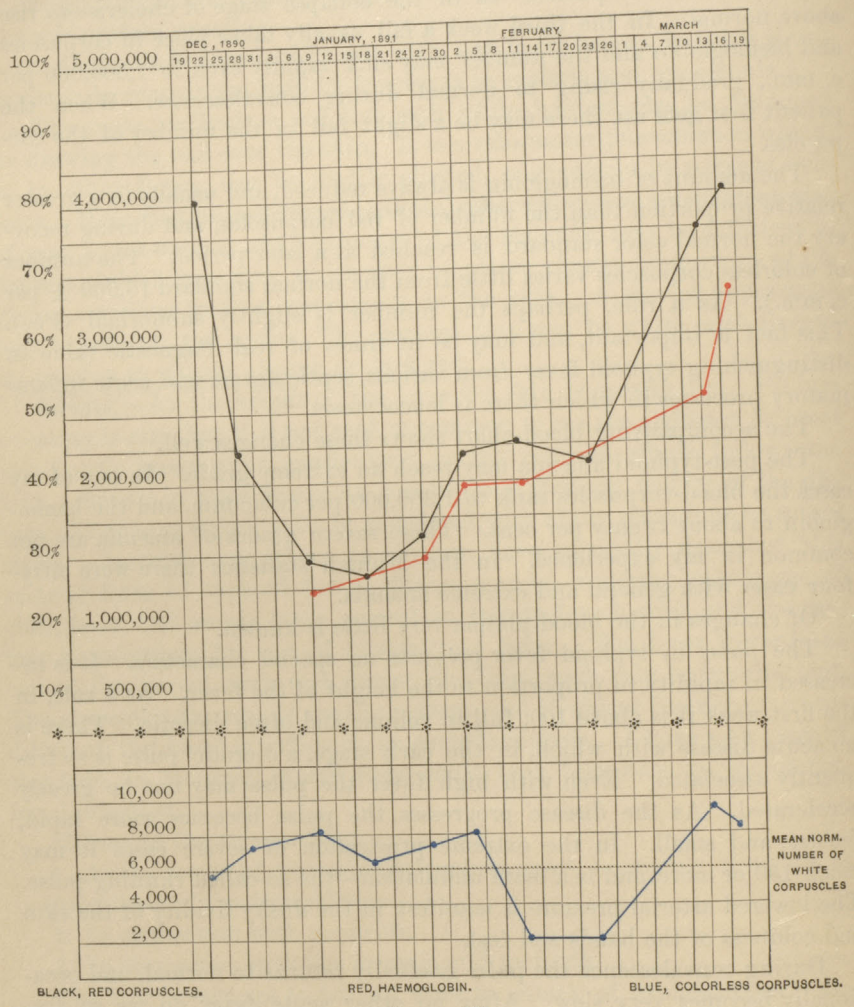
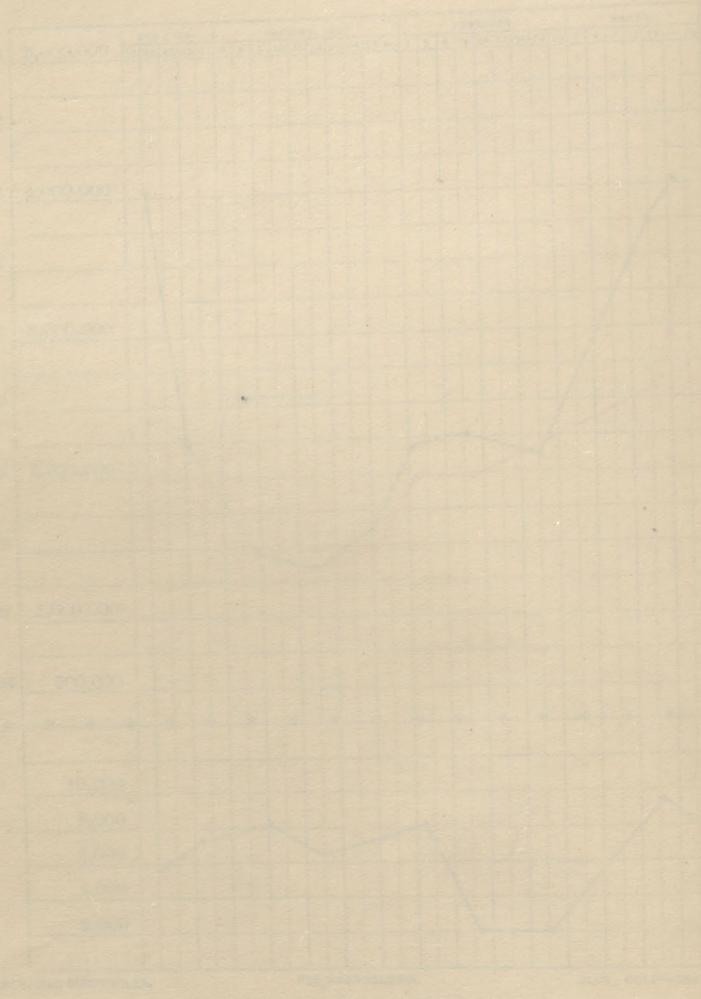


CHART III.

Munich post-mortems. *Endocarditis* is also uncommon. I saw one case at the Philadelphia Hospital. It must be very rare, as there were only eleven cases noted in the Munich records. Myocarditis is more common. The following statement may be made with reference to the condition of the heart-muscle in this disease: In protracted cases the muscle-fibre is usually soft, flabby, and of a pale yellowish-brown color. The softening may be extreme, though rarely of the grade described by Stokes, in which, when held apex up by the vessels, the organ collapsed over the hand,

have seen only two cases; and



forming a mushroom-like cap. Microscopically, the fibres may show little or no change, even when the impulse of the heart has been extremely feeble. A granular parenchymatous degeneration is common. Fatty degeneration may be present, particularly in long-standing cases with anæmia. The hyaline change is not common. The segmenting myocarditis, in which the cement substance is softened so that the muscle-cells separate, has also been found, but it is probably a post-mortem change.

Complications in the Arteries.—Obliteration of large or small arterial trunks is one of the rare complications of typhoid fever. A considerable number of cases are scattered through the literature. The obliteration may be due either to embolism or to thrombosis. In a majority of cases the femoral artery is involved and gangrene of the foot and leg occurs. In several cases there has been obliteration of both femorals with extension of the clot into the aorta and gangrene of both legs. In a case which I saw with Roddick, of Montreal, the obliteration of the left femoral occurred on the sixteenth day. On the twentieth day the patient had pain in the right leg and there was no pulsation in the femoral artery. Gangrene gradually developed in both feet, and death took place in the sixth week. In these cases the condition is probably due to thrombosis, not embolism, and is associated with a blood state which favors clotting, or possibly with a local arteritis. The condition is not invariably fatal. Of twenty cases collected by Barchoud,* eight died.

Thrombi in the Veins.—This is a much more frequent complication, and, according to Murchison, is met with in about one per cent of the cases. It occurs most frequently in a crural vein, and more commonly in the left than in the right; due possibly, as suggested by Liebermeister, to the fact that the left common iliac vein is crossed by the right iliac artery, and does not permit of so free a flow of blood as in the right vein. Thrombosis is indicated by enlargement and œdema of the limb, but gangrene never results from obstruction of the vein alone. It is not a very unfavorable complication. In one case of my series the thrombus had suppurated and there was pyæmia. Occasionally the thrombosis may extend into the pelvic veins and into the vena cava. In one instance the thrombus was in the right circumflex iliac vein alone, and the superficial veins on the right side of the abdomen were in consequence greatly enlarged. Sudden death has been caused by dislodgment of a thrombus.

Infarcts in the kidneys, spleen, and lungs are by no means uncommon in typhoid fever. They are associated usually with thrombosis in the arteries, rarely with embolism.

Digestive System.—Loss of appetite is early, and, as a rule, the relish for food is not regained until convalescence. Thirst is constant, and should be fully and freely gratified. Even when the mind becomes benumbed and the patient no longer asks for water, it should be freely given.

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* Paris Thesis, 1881.

The *tongue* presents the changes inevitable in a prolonged fever, but there are no distinctive characters. Early in the disease it is moist, swollen, and coated with a thin white fur, which, as the disease progresses, becomes denser. It may remain moist throughout. In severe cases, particularly those with delirium, the tongue becomes very dry, partly owing to the fact that such patients breathe with the mouth open. It may be covered with a brown or brownish-black fur, or with crusts between which are cracks and fissures. In these cases the teeth and lips may be covered with a dark brownish matter called *sordes*—a mixture of food, epithelial *débris*, and micro-organisms. By keeping the mouth and tongue clean from the outset the fissures, which are extremely painful, may be prevented. During convalescence the tongue gradually becomes clean, and the fur is thrown off, either insensibly or occasionally in flakes.

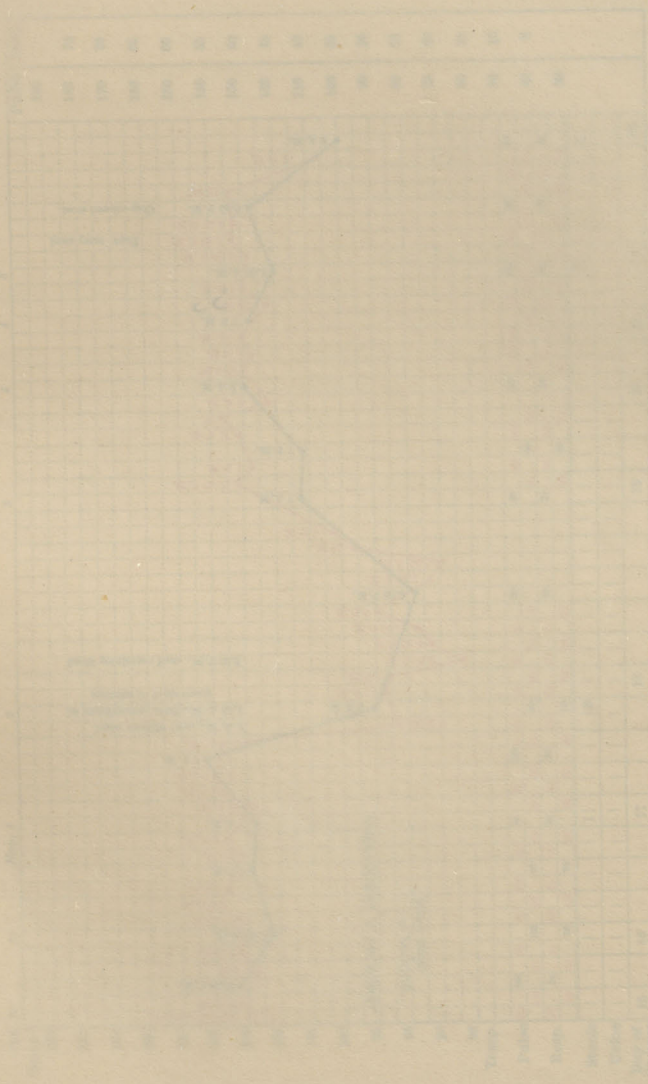
The secretion of saliva is often diminished ; salivation is rare.

Parotitis is not so common as in typhus fever. It was present in forty-five of the two thousand Munich cases. It did not occur in any of my series of fatal cases. It is usually unilateral, and in a majority of cases goes on to suppuration. It is regarded as a very fatal complication, but recovery has followed in four or five of my cases. It undoubtedly may arise from extension of inflammation along Steno's duct. This is probably not so serious a form as when it arises from metastatic inflammation.

The *pharynx* may be the seat of slight catarrh. Sometimes the fauces are deeply congested. Membranous pharyngitis is a serious and fatal complication, which may come on in the third week.

The *gastric symptoms* are extremely variable. Nausea and vomiting are not common. There are instances, however, in which vomiting, resisting all measures, is a marked feature from the outset, and may directly cause death from exhaustion. Vomiting does not often occur in the second and third week, unless associated with some serious complication. In a few of these cases ulcers have been found in the stomach.

Of intestinal symptoms, *diarrhœa* is the most important. In some epidemics constipation exists, but in any long series of cases diarrhœa will be found to be a prominent feature of the disease. Its absence must not be taken as an indication that the intestinal disease is of slight extent. I have seen, on several occasions, the most extensive infiltration and ulceration of the Peyer's glands of the small intestine, with the colon filled with solid fæces. The diarrhœa is caused less by the ulcers than by the associated catarrh, and, as in tuberculosis, it is probable that when this is in the large intestine the discharges are more frequent. It is most common toward the end of the first and throughout the second week, but it may not occur until the third or even the fourth week. The number of discharges ranges from three to eight or ten in the twenty-four hours. They are usually abundant, thin, grayish-yellow, granular, of the consistency and appearance of pea-soup, and resemble very much, as Addison



remarked, the normal contents of the small bowel. The reaction is alkaline and the odor offensive. On standing, the discharges separate into a thin serous layer, containing albumen and salts, and a lower stratum, consisting of epithelial *débris*, remnants of food, and numerous crystals of triple phosphates. Blood may be in small amount, and only recognized

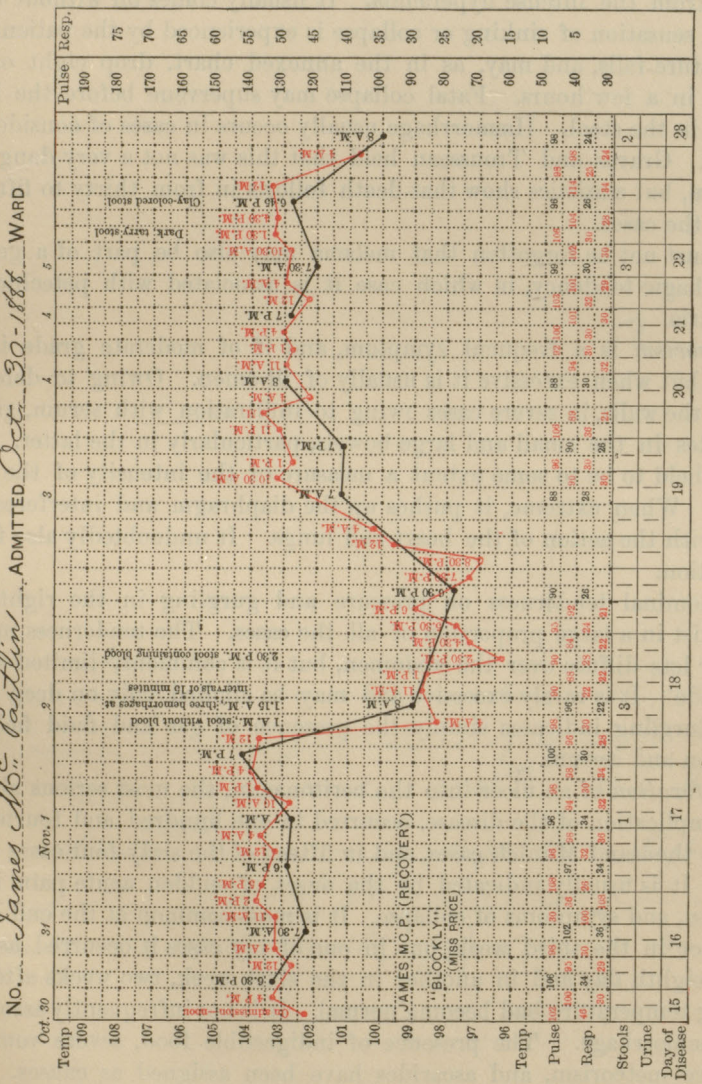


CHART IV.—Hæmorrhage from the bowels. Rapid fall of temperature.

by the microscope. Sloughs of the Peyer's glands occur either as grayish-yellow fragments or occasionally as ovoid masses, an inch or more in length, in which portions of the bowel tissue may be found.

Hæmorrhage from the bowels is a serious complication, occurring in from 3 to 5 per cent of all cases. It occurred in ninety-nine of the two

thousand Munich autopsies, and it was present in nine of my cases. There may be only a slight trace of blood in the stools, but too often it is a profuse, free hæmorrhage, which rapidly proves fatal. It occurs most commonly between the end of the second and the beginning of the fourth week, the time of the separation of the sloughs. Occasionally it results simply from the intense hyperæmia. It usually comes on without warning. A sensation of sinking or collapse is experienced by the patient, the temperature falls, and may, as in the annexed chart, drop eight or ten degrees in a few hours. Fatal collapse may supervene before the blood appears in the stool. Hæmorrhage usually occurs in cases of considerable severity. Graves and Trousseau held that this was not a very dangerous symptom, but statistics show that death follows in from thirty to fifty per cent of the cases.

It must not be forgotten that melæna may also be part of a general hæmorrhagic tendency, in which case it is associated with petechiæ and hæmaturia.

Meteorism is a frequent symptom, and if of moderate grade is not serious, but when excessive it is usually of ill-omen. Owing to defective tone in the walls, in severe cases owing to infiltration with serum, gas accumulates in the small and large bowels, particularly in the latter. It is rightly held to be to some extent a measure of the intensity of the local lesions. When extreme, it pushes up the diaphragm and interferes very much with the action of the heart and lungs. It undoubtedly also favors perforation.

Abdominal tenderness on pressure and gurgling in the right iliac fossa exist in a large proportion of all the cases. The tenderness may be more or less diffuse over the abdomen, but it is commonly limited to the right side. It is rarely excessive and may be elicited only on deep pressure. Gurgling indicates simply the presence of gas and fluid fæces in the colon and cæcum.

Perforation of an ulcer into the peritonæum, the most serious abdominal complication of the disease, occurred in one hundred and fourteen of the two thousand Munich cases, and in fifteen of the sixty-four cases of my series. It is usually indicated by the onset of sudden acute pain in the abdomen, and symptoms of collapse. It is most common at the end of the second or in the third week, but in one of my cases it occurred as early as the eighth day and in another in the sixth week, two weeks after the evening temperature had become normal. It is not infrequently associated with hæmorrhage. The presence of indigestible food, severe vomiting, excessive meteorism, and ascarides have been assigned as causes. This accident is much more common in men than in women. The perforation is usually in the ileum, but may occur in the colon. As a rule it promptly causes symptoms of peritonitis—distention of the abdomen, marked tenderness, rigidity of the abdominal walls, vomiting, a collapsed, pinched expression, and a rapid, small pulse. In very severe cases with marked

Occasionally, severe pain may be due to associated with the degeneration of the abd muscles or rupture of the rectus abd?. It is stated that the uterus may be felt in typhoid fever and also that the mesenteric glands may be palpable (Obrastzoff). Rev. de Med Nov 1884.

mental disturbance the symptoms may not excite suspicion, but the temperature usually falls and the symptoms of collapse are well marked. The diagnosis is easy, except in cases in which tympanites and tenderness have been prominent features, when it may be very difficult to say whether perforation has occurred. An indication of value in such instances is the obliteration of the liver dulness by gas in the peritoneal cavity, a symptom upon which Alonzo Clark and Flint laid great stress, and the value of which I have on several occasions been able to demonstrate. It is somewhat lessened by the fact that extreme tympany may almost, if not quite, obliterate the liver dulness. Recovery from perforation is undoubtedly possible, though rare.

Peritonitis without perforation may also occur by extension from the ulcer or occasionally by rupture of a softened mesenteric gland. It was present in 2·2 per cent of the Munich autopsies.

The *spleen* is invariably enlarged in typhoid fever, and in a majority of cases the edge can be felt below the costal margin. By the end of the first week the enlargement is evident, unless there is great distention of the colon, when the spleen may be pushed far back and difficult to feel. Even the normal area of dulness may not be obtainable. I have seen a very large spleen post mortem, when during life the increase in size was not observable. Toward the fourth week it diminishes in size. In four of my autopsies it weighed less than normal. Infarcts and abscesses are occasionally found. Rupture of the spleen in typhoid fever, due to a slight blow, has been seen by Bartholow. Spontaneous rupture may also occur.

Liver.—Symptoms on the part of this organ are rare. Enlargement is occasionlly detected. Jaundice is a very rare complication. It may be either of a catarrhal nature or due to parenchymatous changes. It was present in only 1·1 per cent of the Munich autopsies. Abscess of the liver is a very rare sequela.

Respiratory System.—*Epistaxis* is an early symptom in many cases, and precedes typhoid fever more commonly than it does any other febrile affection. It is occasionally profuse and serious.

Laryngitis is not very common. The ulcers and the perichondritis have already been described. Œdema apart from ulceration is rare. In this country the laryngeal complications of typhoid fever seem much less frequent than on the Continent. I have seen ulcers in only four or five instances, and twice only perichondritis, both of which cases recovered, one after the expectoration of large portions of the thyroid cartilage.

Bronchitis is one of the most frequent initial symptoms. It is indicated by the presence of numerous piping râles. It may come on with great severity, and in a case at the Philadelphia Hospital I regarded for several days the bronchial catarrh as the primary affection. The smaller tubes may be involved, producing urgent cough and even slight cyanosis. Collapse and lobular pneumonia may also occur.

Lobar pneumonia is met with under two conditions :

1. It may be the initial symptom of the disease. After an indisposition of a day or so, the patient is seized with a chill, has high fever, pain in the side, and within forty-eight hours there are signs of consolidation, and the evidences of an ordinary lobar pneumonia. The intestinal symptoms may not develop until toward the end of the first week or later; the pulmonary symptoms persist, crisis does not occur; the aspect of the patient changes, and by the end of the second week the clinical picture is that of typhoid fever. Spots may then be present and doubts as to the nature of the case are solved. In other instances, in the absence of a characteristic eruption the case remains dubious, and it is impossible to say whether the disease has been pneumonia, in which the so-called typhoid symptoms have developed, or whether it was typhoid fever with early implication of the lungs. Whether this condition depends upon the pneumococcus or is the result of an early localization of the typhoid bacillus has not yet been settled. I have twice performed autopsies in cases of this *pneumo-typhus*, as it is called by the French and Germans, and can speak positively of its onset with all the symptoms of a frank pneumonia.

2. Lobar pneumonia forms a serious and by no means infrequent complication of the second or third week. It was present in over 8 per cent of the Munich cases and occurred in nine of my cases. The symptoms are usually not marked There may be no rusty sputa, and, unless sought for, the condition is frequently overlooked. Infarction, abscess and gangrene are occasional pulmonary complications.

Hypostatic congestion of the lungs and œdema, due to enfeebled circulation in the later periods of the disease, are very common. The physical signs are defective resonance at the bases, feeble breath-sounds, and, on deep inspiration, moist râles. Pleurisy is by no means an uncommon complication. It was present in about 8 per cent of the Munich autopsies. It may develop slowly in convalescence, in which case it is almost always purulent. Another occasional pulmonary complication is *hæmoptysis*, which I once saw at the height of the disease. After death, no lesions of the lungs or bronchi were discovered. Miliary tuberculosis occasionally develops, and some writers hold that there is a greater susceptibility to infection with the tubercle bacillus after this than after other fevers.

Nervous System.—As already noted, the disease may set in with intense and persisting headache or an aggravated form of neuralgia. There are cases in which the effect of the poison is manifested on the nervous system early and with the greatest intensity. There are headache, photophobia, retraction of the neck, marked twitching of the muscles, rigidity, and even convulsions. In such cases the diagnosis of meningitis is invariably made. I have examined post mortem three such cases, in two of which the diagnosis of cerebro-spinal fever had been made. In not one of them was there any trace of meningeal inflammation, only the most intense congestion of the cerebral and spinal pia. Meningitis, however, may occur, but is extremely rare, as shown by the Munich record, in which

at the outset - pleuro-typhoid - or

It may be the initial symptom of the disease. After an indisposition of a day or so, the patient is seized with a chill, has high fever, pain in the side, and within forty-eight hours there are signs of consolidation, and the evidences of an ordinary lobar pneumonia. The intestinal symptoms may not develop until toward the end of the first week or later; the pulmonary symptoms persist, crisis does not occur; the aspect of the patient changes, and by the end of the second week the clinical picture is that of typhoid fever. Spots may then be present and doubts as to the nature of the case are solved. In other instances, in the absence of a characteristic eruption the case remains dubious, and it is impossible to say whether the disease has been pneumonia, in which the so-called typhoid symptoms have developed, or whether it was typhoid fever with early implication of the lungs. Whether this condition depends upon the pneumococcus as is the result of an early localization of the typhoid bacillus has not been settled. I have twice performed autopsies in cases of this pneumo-typhus, as it is called by the French and Germans, and can speak positively of its coexist with all the symptoms of a frank pneumonia.

Lobar pneumonia forms a serious and by no means infrequent complication of the second or third week. It was present in over 5 per cent of the Municipal cases, and observed in nine of my cases. The symptoms usually not marked. There may be no rusty sputa, and, unless looked for, the condition is frequently overlooked. Infarction, abscess, and gangrene are occasional pulmonary complications.

Hypostatic congestion of the lungs and oedema, due to enfeebled circulation in the later periods of the disease, are very common. The physical signs are indefinite resonance at the base, feeble breath-sounds, and, on deep inspiration, moist rales. Pleurisy is by no means an uncommon complication. It was present in [illegible] cases of the Municipal autopsies. It usually [illegible] is associated with [illegible] effusion.

Nervous System.—As already noted, the disease may set in with intense and persisting headache or as a graver form of neuralgia. There are cases in which the effect of the poison is manifested on the nervous system early and with the greatest intensity. There are headache, [illegible] delirium, retraction of the neck, marked twitching of the muscles, rigidity, and even convulsions. In such cases the diagnosis of meningitis [illegible]

And may cause chills & septic symptoms; Eye affections are rare but cataract has been known to follow in young persons. (Fredenwald some references & several cases.

True tetany occurs sometimes - and a number of cases have occurred in certain epidemics. It may occur during the full height of the disease. This complication is extremely rare in this country - and Janeway - so far as I know has alone reported instances

there were only eleven among the two thousand cases. Stokes's dictum that "there is no single nervous symptom which may not and does not occur independently of any appreciable lesion of the brain, nerves, or spinal cord," is too often forgotten.

Delirium is present in all severe cases. It is certainly less frequent under a rigid plan of hydrotherapy. It may be present from the outset, but usually does not develop until the second and sometimes not until the third week. It may be slight and only nocturnal. It is, as a rule, a quiet delirium, though there are cases in which the patient is very noisy and constantly tries to get out of bed, and, unless carefully watched, may escape. The patient does not often become maniacal. In heavy drinkers the delirium may have the character of delirium tremens. Even in cases which have no positive delirium, the mental processes are usually dulled and the patient is listless and apathetic. In severe cases the patient passes into a condition of unconsciousness. The eyes may be open, but he is oblivious to all surrounding circumstances and neither knows nor can indicate his wants. The urine and fæces are passed involuntarily. In this pseudo-wakeful state, or coma vigil as it is called, the eyes are open and the patient is constantly muttering. The lips and tongue are tremulous; there is twitching of the fingers and wrists—subsultus tendinum and carphologia. He picks at the bedclothes or grasps at invisible objects. These are among the most serious symptoms of the disease, and always indicate danger.

Among important complications and sequelæ are several nervous affections. The *paralyses* are due in the majority of instances to neuritis. It may be of a paraplegic type, or may involve only one or two nerves. Occasionally, as in a case reported by George Ross,* all four limbs are affected.

Possibly some of these cases are due to poliomyelitis, not to neuritis. This affection does not always follow, but may come on at the height of the disease, as in a case recently under my care, in which during the second week neuritis developed in both arms. Among other sequences may be mentioned aphasia, which is more apt to occur in young children, and great slowness of speech, which may or may not be associated with mental weakness.

Post-febrile *insanity* is perhaps more frequent after typhoid than after any other disease. Wood regards it as confusional insanity, the result of impaired nutrition and exhaustion of the nervous centres. Five cases have come under my observation, in four of which recovery took place.

Disturbances of the organs of the special senses are rare. Otitis media occasionally develops. Ocular symptoms are uncommon.

Renal System.—Retention of urine is an early symptom in many

* Paralysis in Typhoid Fever. Transactions of the Association of American Physicians, vol. iii.

cases, and is more frequent in some epidemics than in others. The urine is usually diminished at first, has the ordinary febrile characters, and the pigments are increased. Later in the disease it is more abundant and lighter in color.

Ehrlich has described a reaction, which he believes is rarely met with except in typhoid fever. This so-called *diazo-reaction* is produced as follows: Two solutions are employed, kept in separate bottles: one containing a saturated solution of sulphanilic acid in a solution of hydrochloric acid (50 c. c. to 1,000 c. c.); the other a ½ per cent solution of sodium nitrite. To make the test, a few cubic centimetres of urine are placed in a small test-tube with an equal quantity of a mixture of solution of the sulphanilic acid (40 c. c.) and the sodium nitrite (1 c. c.), the whole being thoroughly shaken. One cubic centimetre of ammonia is then allowed to flow carefully down the side of the tube, forming a colorless zone above the yellow urine, and at the junction of the two a deep brownish-red ring will be seen if the reaction is present. With normal urine a lighter brownish ring is produced, without a shade of red. The color of the foam of the mixed urine and reagent, and the tint they produce when largely diluted with water, are characteristic, being in both cases of a delicate rose-red if the diazo-reaction be present; but if not, brownish-yellow.

In twenty-six cases at my clinic, Simon found the reaction in twenty-two. It may be present previous to the occurrence of the rash, and as late as the twenty-second day. The value of the test is lessened by its occurrence in cases of miliary tuberculosis, and occasionally in the acute diseases associated with high fever.

The renal complications in typhoid fever may be thus grouped:

(*a*) Febrile albuminuria, which is very common and of no special significance; thus, in the first seventy-five cases admitted to the Johns Hopkins Hospital, albumen was present in forty-six, and in twenty-five cases casts were also found. In only two of these cases were there indications of an acute Bright's disease.

(*b*) Acute nephritis occurring at the onset or during the height of the disease—the *nephro-typhus* of the Germans, the *fièvre typhoïde à forme rénale* of the French—may set in, with all the symptoms of the most intense Bright's disease, masking in many instances the true nature of the malady. After an indisposition of a few days there may be fever, pain in the back, and the passage of a small amount of bloody urine. In a recent case * the early symptoms were all those of the most severe nephritis, and death occurred on the fourteenth day from perforation of the bowel. In other instances, as in a case reported in the same paper, the nephritis sets in at the end of the first or during the second week, and may modify con-

* Acute Nephritis in Typhoid Fever. Johns Hopkins Hospital Reports, February, 1890.

The condition may persist for several weeks

Pyuria

Chungi see Heuelsons paper + Flexners report of case.

The typhoid bacilli have been demonstrated in pus from a necrotic rib.

There is a remarkable disorder of convalescence to which Gibney has given the name "Typhoid Spine". The patient has usually been up & about when Gibney have had an slight fall or shock, after which he complains of great pain in the back & pain in moving the legs. These may persist for weeks without any fever or signs of Pott's disease, spondylitis or neuritis. There may also be also marked nervous or hysterical symptoms. The outlook is good. It is not known upon what this condition depends. It seems to be a neuritis rather than a perispondylitis as Gibney suppose.

A

siderably the character of the disease, and even render the diagnosis doubtful.

(*c*) The nephritis of convalescence. This is more common but less serious. It develops after the fall of the fever, and is usually associated with œdema. It does not present characters different from the ordinary post-febrile nephritis.

(*d*) The remarkable lymphomatous nephritis described by E. Wagner and others, and already referred to in the section on morbid anatomy, produces, as a rule, no symptoms.

(*e*) *Post-typhoid pyelitis.*—In this the pelves of the kidney and the calices are at first covered with a membranous exudation, but erosion and ulceration may subsequently occur. There may be blood and pus in the urine. This condition occurred in three of my cases, in one of which it was associated with extensive membranous inflammation of the bladder.

Simple catarrh of the bladder is rare.

Orchitis is occasionally met with during convalescence. Sadrain collected sixteen cases in the literature. It is usually associated with a catarrhal urethritis. Induration or atrophy may occur, and more rarely suppuration.

Osseous System.—A multiple arthritis occasionally occurs; more commonly it is limited to a single joint, and may pass on to suppuration. Spontaneous luxation may develop. Necrosis is not uncommon during convalescence. Keen collected thirty-seven cases after typhoid fever. It is probably always the result of a secondary infection. Its most usual seat is the tibia.

The *muscles* show in some cases the degeneration already referred to, but it does not cause any symptoms. Hæmorrhage occasionally occurs into the muscles, and later in the disease abscess may develop.

Association of other Diseases.—Erysipelas is a rare complication, most commonly met with during convalescence. In 1,420 cases at Basle it occurred ten times. Griesinger states that it is met with in 2 per cent.

Measles may develop during the fever or in convalescence. Chicken-pox and noma have been reported in children. Pseudo-membranous inflammations may occur in the pharynx, larynx, or genitals. Malarial and typhoid fevers may be associated, but a majority of the cases of so-called typho-malarial fever are either remittent or true typhoid.

Varieties of Typhoid.—Typhoid fever is an extremely complex disease. Many forms have been described, some of which present exaggeration of common symptoms, others modification in the course, others again greater intensity of action on certain organs. As we have seen, when the nervous system is specially involved, it has been called the cerebro-spinal form; when the kidneys are early and severely affected, nephro-typhoid; when the disease begins with pulmonary symptoms, pneumo-typhoid; when the disease is characterized throughout by profuse

sweats, the sudoral form of the disease. It is a mistake, I think, to recognize or speak of these as varieties. It is enough to remember that typhoid may set in occasionally with symptoms localised in certain organs, and that many of its symptoms are extremely inconstant—in one epidemic uniform and text-book-like, in another slight or not met with. This diversified symptomatology has led to many clinical errors, and in the absence of the salutary lessons of morbid anatomy it is not surprising that practitioners have so often been led astray. We may recognize, with Murchison, the following varieties:

1. The *mild* and *abortive* forms. It is very important for the practitioner to recognize the mild type of typhoid fever, often spoken of as gastric fever or even regarded as simple febricula. In this form, the typhus *levissimus* of Griesinger, the symptoms are similar, in kind but altogether less intense than in the graver attacks, although the onset may be sudden and severe. The temperature rarely reaches 103°, and the fever of onset may not show the gradual ascending evening record. The spleen is enlarged, the rose-spots may be marked; often they are very few in number. The diarrhœa is variable, sometimes it is not present. In such cases the symptoms may persist for from sixteen to twenty days.

In the abortive form the symptoms of onset may be marked with shivering and fever of 103° or even higher. The date of onset is often definite, a point upon which Jürgensen lays great stress. Rose-spots may occur from the second to the fifth day. Early in the second week or at the end of the first week the fever falls, often with profuse sweating, and convalescence is established. In this abortive form relapse may occur and may occasionally prove severe. When typhoid fever prevails extensively these cases are not uncommon. I agree with J. C. Wilson, who states that they are not nearly so common in this country as in Europe.

2. The *grave* form is usually characterized by high fever and pronounced nervous symptoms. In this category, too, come the very severe cases setting in with pneumonia and Bright's disease, and with the very intense gastro-intestinal or cerebro-spinal symptoms.

3. The *latent* or *ambulatory* form of typhoid fever, which is particularly common in hospital practice. The symptoms are often very slight, and the patient scarcely feels ill enough to go to bed. He has languor, perhaps slight diarrhœa, but keeps about and may even attend to his work throughout the entire attack. In other instances delirium sets in. The worst cases of this form are seen in sailors, who keep up and about, though feeling ill and feverish. When brought to the hospital they often develop symptoms of a most severe type of the disease. Hæmorrhage or perforation may be the first symptom of this ambulatory type. Sir W. Jenner has called attention to the dangers of this form, and particularly to the grave prognosis in the case of persons who have travelled far with the disease in progress.

Haemorrhagic typhoid

see R Curtin Phila Hosp Rep. 17 cases only are thus fatal

Cases are not common under the age of ten, and is very rarely met with in infants under 2. Well known cases have been reported in infants suckling (9 mos. fatal 4½ months: Ogle) and perforation has been met with in an infant 5 days old.

Roma

It is to be remembered that only a careful bacteriological examination may suffice to decide between the swollen bodies & mesenteric glands - not uncommon in children with fever - are due to the typhoid bacillus and true typhoid fever.

Typhoid fever in pregnancy

Cultures have been made from the foetus delivered at the result which lived four days. Lungs spleen liver and showed typhoid bacillus (Jaworski. Munch. Med. Wochen. 1894. (N.Y. M. Journ 1894 p. 564

There is a rare and fatal form of typhoid fever, characterized by cutaneous and mucous hæmorrhages.

An *afebrile* typhoid fever is recognized by authors. Liebermeister says that the cases were not uncommon at Basle. The patients presented lassitude, depression, headache, furred tongue, loss of appetite, slow pulse, and even the spots and enlarged spleen. I have no personal knowledge of such cases.

Typhoid Fever in Children.—Epistaxis rarely occurs; the rise in temperature is less gradual; the initial bronchial catarrh is often observed. The nervous symptoms are often prominent; there are wakefulness and delirium; diarrhœa is often absent. The rash may be very slight, but the most copious eruption I have ever seen was in a child of eight. Oddly enough, considering the readiness with which the lymph elements of the intestine in children are involved, the abdominal symptoms are slight. Fatal hæmorrhage and perforation are rare. Among the sequelæ, aphasia and bone lesions may be mentioned as more common in children than in adults. The mortality of typhoid fever in children is low. Forchheimer, in the Cincinnati epidemic in 1888, treated seventy cases without a death.

Typhoid Fever in the Aged.—After the fortieth year the disease runs a less favorable course, and the mortality is very high. Of sixty-four fatal cases, seven were over forty years of age; one was aged sixty-three, another seventy. The fever is not so high, but complications are more common, particularly pneumonia and heart failure.

Relapse.—Relapses vary in frequency in different epidemics, and, it appears, in different places. The percentages of different authors range from 3 per cent (Murchison), 11 per cent (Bäumler) to 15 or 18 per cent (Immermann). In Wagner's clinic, from 1882 to 1886, there were 49 relapses in 561 cases. F. C. Shattuck reports 21 relapses in 129 cases. R. L. MacDonnell 1 relapse in 100 cases. A relapse is a repetition, sometimes only a summary, of the original attack. Von Ziemssen insists correctly that two of the three important symptoms—step-like temperature at onset, roseola, and enlarged spleen—should be present to determine the diagnosis of a relapse. The intestinal lesions are repeated, though with less intensity and regularity. It is to be carefully distinguished from the fever of convalescence—or recrudescence—which has already been described. This is usually transitory, not lasting longer than a day or two. There are occasional instances in which the fever lasts for four or five days without rose-spots, or without enlargement of the spleen, and it may be impossible to determine whether there has been a relapse or not. The true relapse usually sets in after complete defervescence. Irvine noted the average duration of the interval in his cases at a little over five days. In eleven of Shattuck's cases the relapse began before complete defervescence. The onset is usually abrupt, though the step-like ascent is sometimes well seen, as in Chart I. The

eruption may be seen as early as the third or fourth day. The attack is usually less severe and of shorter duration. Of Murchison's fifty-three cases the mean duration of the first attack was about twenty-six, of the interval eleven, of the relapse fifteen days. The mortality of the relapse is not high. The relapse may be repeated, and a third and fourth relapse may occur.

The relapse is a reinfection from within, but we are still quite ignorant of the conditions favoring its occurrence. It is not at all likely that any special methods of treatment favor the relapse, though hydrotherapy has labored under this reproach.

Diagnosis.—If the patient is seen from the outset there is rarely any difficulty in diagnosing typhoid fever of typical course. In the prefebrile period the headache, weakness, loss of appetite and epistaxis are extremely suggestive, and, with an ascending pyrexia, scarcely need the distinctive rash to clinch the diagnosis.

The early and intense localisation of the symptoms in certain organs is a frequent source of error in diagnosis.

Cases coming on with severe headache, photophobia, delirium, twitching of the muscles and retraction of the head are almost invariably regarded as cerebro-spinal meningitis. Under such circumstances it may for a few days be impossible to make a satisfactory diagnosis. I have thrice performed autopsies on cases of this kind in which no suspicion of typhoid fever had been present; the intense cerebro-spinal manifestations having dominated the scene. Until the appearance of abdominal symptoms or the rash, it may be quite impossible to determine the nature of the case. Cerebro-spinal meningitis is, however, a rare disease; typhoid fever a very common one, and the onset with severe nervous symptoms is by no means infrequent. Fully one half of the cases of the so-called brain-fever belong to this category.

I have already spoken of the misleading pulmonary symptoms, which occasionally develop at the very outset of the disease. The bronchitis rarely causes error, though it may be intense and attract the chief attention. More difficult are the cases setting in with chill and followed rapidly by pneumonia. I have brought such a case before the class one week as typical pneumonia, and a fortnight later shown the same case as undoubtedly one of typhoid fever. In another case, in which the onset was with definite pneumonia, no spots developed, and, though there were diarrhœa, meteorism, and the most pronounced nervous symptoms, the doubt still remains whether it was a case of typhoid fever or one of pneumonia in which severe secondary symptoms developed. There is less danger of mistaking the pneumonia which develops at the height of the disease, and yet this is possible, as in a case admitted a few months ago to my wards—a man aged seventy, insensible, with a dry tongue, tremor, ecchymoses upon the wrists and ankles, no rose-spots, enlargement of the spleen, and consolidation of his right lower lobe. It was very

See Stewart's article, Practitioner, 309.

Joseph Leidy Jr. has recorded a case of a man ~~aged 34~~ typhoid fever when 16 & a second attack six months later. A third ~~who had had three attacks of typhoid fever at intervals from~~ attack occurred in his 34th year which was followed by five relapses, in the ~~relapses~~ (Univ. Med. Mag. 1892 third of which a seizure of ~~epis~~ occurred.

second attack

a medical student

Jas. ~~Henderson~~ (McGee '91) had typhoid fever in his final year & a second attack the next year when a resident in the M.G.H. Both attacks quite typical. - (M.G.H. Rep.)

Wolff from the German hospital reports the case of a girl aged 19th with a well defined attack in March and a second in September of the same year (Med News. 4-1894)

In some instances of Absence decreased suppuration without chills or sweats may simulate typhoid in a low long continued fever. The presence or absence of gleucocytosis would be an important aid

natural, particularly since there was no history, to regard such a case as senile pneumonia with profound constitutional disturbance, but the autopsy showed the characteristic lesions of typhoid fever.

In malarial regions typhoid and remittent fevers are very frequently confounded. I confess myself unable to differentiate certain cases of malarial remittent from typhoid fever, without the blood examination. I have repeatedly, both in Philadelphia and Baltimore, sent cases to the wards as typhoid fever which subsequently proved to be ordinary malarial remittent. The patient comes with a history of *malaise*, weakness, diarrhœa, perhaps vomiting; the tongue is furred and white, the cheeks are flushed, the spleen is slightly enlarged, temperature 102° or 103°. There may indeed be delirium, and the clinical picture of the early stage of typhoid fever may be complete. On at least two occasions I have shown such cases to my class as typhoid fever, and several times patients have been sent to the wards with instructions to have the head shaved and to begin the baths. The only safeguard against error is the examination of the blood, which should be done systematically in regions in which malaria prevails. The presence of Laveran's organisms is ~~distinctive and~~ absolutely diagnostic.

Acute miliary tuberculosis is not infrequently mistaken for typhoid fever. The points in differential diagnosis will be discussed under that disease. Tuberculous peritonitis in certain of its forms may closely simulate typhoid fever.

Puncture of the spleen for the purpose of obtaining cultures is justifiable only in exceptional circumstances.

Prognosis.—The mortality ranges from 10 to 30 per cent. Of the enormous number of deaths analyzed by Murchison, the mortality was nearly 19 per cent. The death-rate at the Montreal General Hospital, for twenty years, was 11·2 per cent. In recent years the mortality in typhoid fever has certainly diminished, and, under the influence of Brand, the reintroduction of hydrotherapy has reduced the mortality in institutions in a remarkable manner, even as low as 5 or 6 per cent. Especially unfavorable symptoms are high fever, delirium with toxic symptoms, hæmorrhage—though by some this is not thought very unfavorable—and peritonitis.

Sudden Death.—It is difficult in many cases to explain this most lamentable of accidents in the disease. There are cases in which neither cerebral, renal, nor cardiac changes have been found, and instances too in which it does not seem likely that there could have been a special localisation of the toxic poisons in the pneumogastric centres. McPhedran, in reporting a case of the kind, in which the post-mortem showed no adequate cause of death, suggests that the experiments of McWilliams on sudden cardiac failure probably explain the occurrence of death in certain of these cases in which neither embolism nor uræmia is present. Under conditions of abnormal nutrition there is sometimes induced a state

of *delirium cordis*, which may develop spontaneously, or, in the case of animals, on slight irritation of the heart, with the result of extreme irregularity and finally failure of action. It occurs more frequently in men than in women, according to Dewèvre's statistics, in a proportion of 114 to 26. It may occur at the height of the fever, and, as pointed out by Graves, may also happen during convalescence.

Fat subjects stand typhoid fever badly. The mortality in women is greater than in men. The complications and dangers are more serious in the ambulatory form in which the patient has kept about for a week or ten days. Early involvement of the nervous system is a bad indication; and the low, muttering delirium with tremor means a close fight for life. Prognostic signs from the fever alone are deceptive. A temperature above 104° may be well borne for many days if the nervous system is not involved.

Prophylaxis.—In cities the prevalence of typhoid fever is directly proportionate to the inefficiency of the drainage and the water-supply. There is no truer indication of the sanitary condition of a town than the returns of the number of cases of this disease. With the improvement in drainage the mortality in many cities has been reduced one half or even more. One of the most striking instances is afforded by the city of Munich. Von Ziemssen has published charts illustrating the extraordinary reduction in the prevalence of typhoid fever since the completion of the drainage system of that city. The average yearly number of admissions to hospital of cases of typhoid fever was, between the years 1866 and 1880, 594, while from 1881 to 1888 inclusive, the average has been only about 100. During this same period the typhoid mortality of the whole city presented a yearly average of 208, but from 1881 to 1888 the yearly average was only 40.

By most rigid methods of disinfection much may be done to prevent the spread of the infection.

The following procedures, suggested by Fitz, should be carried out in hospital practice, and, with modifications, in private houses:

1. "Mattresses and pillows (when liable to become soiled) are to be protected by close-fitting rubber covers.

2. "Bed and body linen are to be changed daily. Bed-spreads, blankets, rubber sheets and rubber covers are to be changed at once when soiled. Avoid shaking any of the articles.

3. "All changed linens, bath-towels, rubber sheets and covers are to be immediately wrapped in a sheet soaked in carbolic acid (one to forty). Remove them to the rinse-house as soon as possible, and soak six hours in carbolic acid (one to forty). Then boil the linen for a half-hour, and wash with soft soap. The rubber sheets and covers are to be rinsed in cold water, dried, and aired for eight hours. The bed-spreads and blankets are to be aired eight hours daily.

4. "Feeding-utensils, immediately after using, are to be thoroughly cleansed in boiling water.

Sudden death.

How early in the disease are the discharges infectious?

Case should be taken to thoroughly cook oysters which are gathered in positions or streams contaminated with sewage.

Treatment sheet - copy of

5. "Dejections are to be received into a bed-pan containing half a pint of carbolic acid (one to twenty). The nates are to be cleansed with paper, and afterward with a compress cloth wet with carbolic acid (one to forty).

6. "Add two quarts of carbolic acid (one to twenty), in divided portions, to the contents of the bed-pan; mix thoroughly by shaking and throw the liquid into the hopper. The bed-pan and hopper are to be cleansed with carbolic acid (one to twenty) and wiped dry. The cloth used for the above purpose is to be at once burned.

7. "The corpse is to be covered with a sheet wet with carbolic acid (one to forty).

8. "After the discharge of the patient from the hospital, the mattresses are to be aired every day for a week. The bedstead is to be washed with corrosive sublimate (one to one thousand).

9. "These directions are to be followed until the patient is free from fever."

When epidemics are prevalent the drinking-water and the milk used in families should be boiled. These precautions should be taken also by recent residents in any locality, and it is much safer for travellers to drink light wines or mineral water rather than ordinary water or milk.

Treatment.—(*a*) **General Management.**—The profession was long in learning that typhoid fever is not a disease to be treated by medicines. Careful nursing and a regulated diet are the essentials in a majority of the cases. The patient should be in a well-ventilated room (or in summer out of doors during the day), strictly confined to bed from the outset, and there remain until convalescence is well established. The bed should be single, not too high, and the mattress should not be too hard. The woven wire bed, with soft hair mattress, upon which are two folds of blanket, combines the two great qualities of a sick-bed, smoothness and elasticity. A rubber cloth should be placed under the sheet. An intelligent nurse should be in charge. When this is impossible, the attending physician should write out specific instructions regarding diet, treatment of the discharges, and the bed-linen.

(*b*) **Diet.**—Those forms of food should be given which are digested with the greatest ease, and which leave behind the smallest amount of residue to form fæces. Milk is the most suitable food. If used alone, three pints at least may be given to an adult in twenty-four hours, always diluted with water, lime-water, or aërated waters. Partially peptonized milk, when not distasteful to the patient, is occasionally serviceable. The stools of a patient on a strictly milk diet should be examined from time to time, to see if the milk is entirely digested. Fever patients often receive more than they can utilize, in which case masses of curds are seen in the stools, or microscopically fat-corpuscles in extraordinary abundance. Under these circumstances it is best to substitute, for part of the milk, mutton or chicken broths, or beef-juice, or a clear *consommé*, all of which may be made

very palatable by the addition of fresh vegetable juices. Some patients will take whey or buttermilk when the ordinary milk is distasteful. Thin barley-gruel, well strained, is an excellent food for typhoid-fever patients. Eggs may be given, either beaten up in milk or, better still, in the form of albumen-water. This is prepared by straining the whites of eggs through a cloth and mixing them with an equal quantity of water. It may be flavored with lemon, and, if the patient is taking spirits, whisky or brandy is very conveniently given with this. Patients who are unable to take milk can subsist for a time on this alone.

The patient should be encouraged to drink water freely, which may be pleasantly cold. Iced tea, barley-water, or lemonade may also be given, and there is no objection to coffee or cocoa in moderate quantities. Fruits are not, as a rule, allowable, though the juice of lemon or orange may be given. Typhoid patients should be fed at stated intervals through the day. At night it depends upon the general condition of the patient whether he should be aroused from sleep, or not. In mild cases it is not well to disturb the patient. When there is stupor, however, the patient should be roused for food at the regular intervals night and day.

Alcohol is not necessary in all cases, but may be given when the weakness is marked, the fever high, and the pulse failing. In young healthy adults, without nervous symptoms and without very high fever, alcohol is not required; but in any case, when the heart-beat is feeble and the first sound becomes obscure, if there is a muttering delirium, subsultus tendinum and a dry tongue, brandy or whisky should be freely given. In such a case from eight to twelve ounces of brandy in the twenty-four hours is a moderate amount.

(*c*) **Treatment of the Fever.**—The persistent pyrexia is in itself a danger, but perhaps not the chief danger. Cases with high fever alone, without delirium or signs of involvement of the nervous system, are not nearly so serious as those cases in which, with a temperature of 104°, there are pronounced nervous symptoms. For the fever and its concomitants there is no treatment so efficacious as that by cold water, introduced at the end of the last century by Currie, of Liverpool, and of late years forced upon the profession by Brand, of Stettin. In institutions a rigid system of hydrotherapy should be carried out. At my clinic the following plan is followed: Every third hour, if the temperature is above 102·5°, the patient is placed in a bath (at 70° Fahr.), which is wheeled to the bedside. In this he remains from fifteen to twenty minutes, and is then taken out, wrapped in a dry sheet and covered with a light blanket. Enough water is used to cover the patient's body to the neck. The head is sponged during the bath, and, if there is much torpor, cold water is poured over it from a height of a foot or two. The rectal temperature is taken immediately after the bath, and again three quarters of an hour later. The patient often complains bitterly when in the bath, and shivering and blueness are almost a constant sequence. Food is usually given

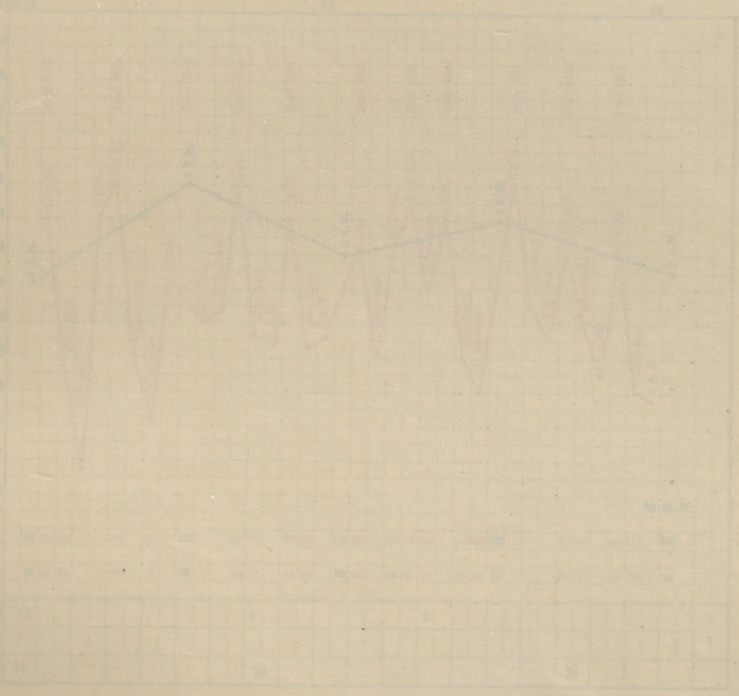


CHART V.

Each time.

with a stimulant after the bath. The only contra-indications are peritonitis and hæmorrhage. Neither bronchitis nor pneumonia are so regarded. It is not necessary to renew the water in the bath more than once in the twenty-four hours. The accompanying chart shows the number of

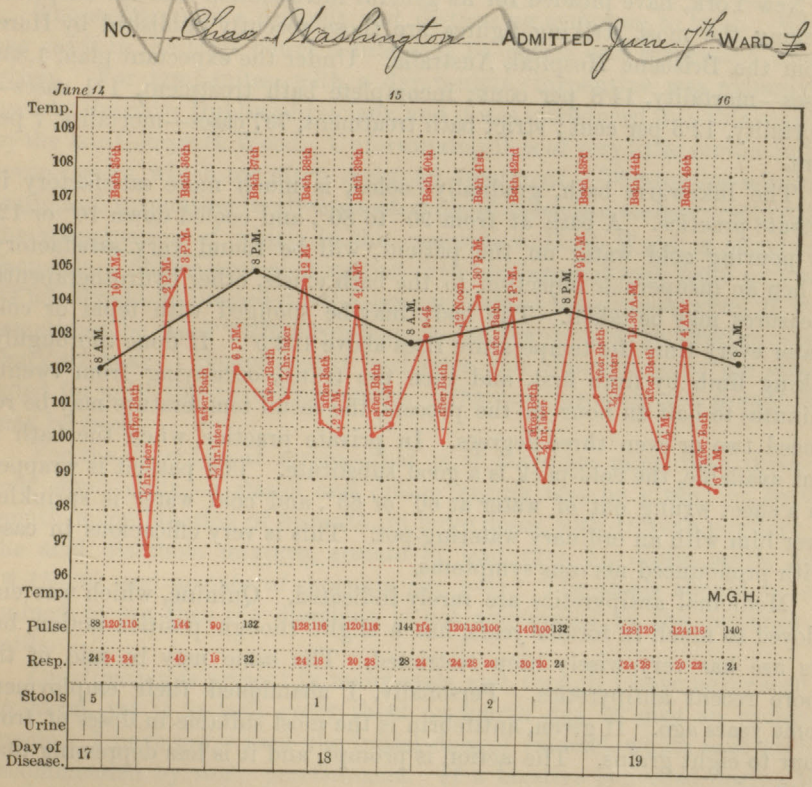


CHART V.

baths and the influence on the fever during two days of treatment. The good effects of the baths are: (1) the reduction of the fever; (2) the intellect becomes clearer, the stupor lessens, and the muscular twitchings disappear; (3) a general tonic action, particularly on the heart; (4) insomnia is lessened, the patient usually falling asleep for two or three hours after each bath; and (5), most important of all, the mortality is, under this plan of treatment, reduced to a minimum. This rigid method is not, however, without serious drawbacks, and personally I sympathize with those who designate it as entirely barbarous. To transfer a patient from a warm bed to a tub at 70° Fahr., and to keep him there twenty minutes or longer in spite of his piteous entreaties, does seem harsh treatment; and the subsequent shivering and blueness look distressing. A majority of our patients complain of it bitterly, and in private practice it is scarcely feasible.

The convincing statistics of the Brand method, as it is called, have

long been before the profession; but so far they have made but little impression in English-speaking communities. Cayley, of London, has been a warm advocate, but the rigid treatment is not often carried out in English or American institutions. J. C. Wilson, of Philadelphia, and Baruch, of New York, have pleaded for its general introduction into our hospitals. Among the most striking figures are those recently published by Hare, from the Brisbane Hospital, Australia. Under the expectant plan, 1,838 cases—mortality, 14·8 per cent; incomplete bath treatment, 171 cases—mortality, 12·3 per cent; strict bath treatment, 797 cases—mortality, 7 per cent.

The lukewarm bath, gradually cooled, is much more satisfactory in private practice. A bath at from 90° to 80°, and cooled down 10° or 12° by pouring cold water on the patient, will be found very satisfactory. When an insuperable objection to the bath exists, other hydrotherapeutic measures may be taken. The body may be sponged with tepid or cold water every time the temperature rises above 102·5°. If done thoroughly, taking limb by limb first, and then the trunk, occupying from twenty minutes to half an hour in the process, the rectal temperature may be reduced two or even three degrees. In private practice, when the bath is not available, the cold-pack is a good substitute. The patient is wrapped in a sheet wrung out of water at 60° or 65°, and cold water is sprinkled over him with an ordinary watering-pot. This is very efficacious in cases with pronounced nervous symptoms.

Medicinal antipyretics are rarely indicated. Quinine, which was employed so much in former years, has a slight though positive action, but its use has very wisely been restricted. The same may be said of the more recent antipyretics. Personally, I abandoned their employment some years ago. If given, antifebrin is the most suitable in doses of from four to eight grains. The action is prompt, and it is less depressing than antipyrin.

(*d*) **Antiseptic Medication.**—Very laudable endeavors have been made in many quarters to introduce methods of treatment directed toward the destruction of the typhoid bacilli, or the toxic agent which they produce, but so far without success. Good results have been claimed from the carbolic and iodine treatment. Others advocate corrosive sublimate or calomel, β-naphthol, and the salicin preparations. I can testify to the inefficiency of the carbolic acid and iodine and of the β-naphthol. With the mercurial preparations I have no experience. Fortunately for the patients, a majority of these medicines meet one of the two objects which Hippocrates says the physician should always have in view—they do no harm. Recently Burney Yeo has advocated the use of chlorine water and quinine, ~~as having a marked antiseptic action~~.

(*e*) **Treatment of the Special Symptoms.**—The abdominal pain and tympanites are best treated by fomentations or turpentine stupes. The latter, if well applied, give great relief. Sir William Jenner, at his clinic,

Irrigation of the colon has been recommended with view to washing out the toxic matters (Murchison) Seibert

used to lay great stress on the advantages of a well-applied turpentine stupe. He directed it to be applied as follows: A flannel roller was placed beneath the patient, and then a double layer of thin flannel, wrung out of hot water, with a few drops of turpentine sprinkled upon it, was applied to the abdomen and covered with the ends of the roller.

The *meteorism* is a difficult and distressing symptom to treat. When the gas is in the large bowel, a tube may be passed or a turpentine enema given. For tympanites, with a dry tongue, turpentine was extensively used by the older Dublin physicians, and it was introduced into this country by the late George B. Wood. Unfortunately it is of very little service in the severer cases, which too often resist all treatment. The routine administration of turpentine in all cases of typhoid fever is a useless practice, for the perpetuation of which, in this generation, H. C. Wood is largely responsible. Stokes protested against it in his day, and very truly said that its use should be limited to the later periods of the disease, when it may sometimes be used with advantage, as Graves directs, in drachm doses every six hours. Sometimes, if beef-juice and albumen-water are substituted for milk, the distention lessens. Charcoal, bismuth, and β-naphthol may be tried.

For the *diarrhœa*, if severe—that is, if there are more than three or four stools daily—a starch and opium enema may be given; or, by the mouth, a combination of bismuth, in large doses, with Dover's powder; or the acid diarrhœa mixture, acetate of lead (grs. 2), dilute acetic acid (♏ 15–20), and acetate of morphia (gr. $\frac{1}{6}$–$\frac{1}{8}$). The stools should be examined to see that the diarrhœa is not aggravated by the presence of curds.

Constipation is present in many cases, and, though I have never seen it do harm, yet it is well every third or fourth day to give an ordinary enema. I have never used the initial dose of calomel, which is so highly recommended by some practitioners. If a laxative is needed during the course of the disease, the Hunyadi-janos or Friedrichshall water may be given.

Hæmorrhage from the bowels is best treated with full doses of acetate of lead and opium. As absolute rest is essential, the greatest care should be taken in the use of the bed-pan. It is perhaps better to allow the patient to pass the motions into the draw sheet. Ice may be freely given, and the amount of food should be restricted for eight or ten hours. If there is a tendency to collapse, stimulants should be given and, if necessary, hypodermic injections of ether. The patient may be spared the usual styptic mixtures with which he is so often drenched. Turpentine is warmly recommended by certain authors.

Peritonitis.—In a majority of the cases this is an inevitably fatal complication. The only hope lies in restriction of the inflammation. Cases have unquestionably recovered. Morphia should be given subcutaneously. If the peritonitis be due to perforation, the question of

laparotomy may be discussed. If perforation has occurred in the second or third week, it would be useless under the circumstances to attempt to stitch a slit in the intestine; if, on the other hand, it occurs during convalescence, it is only right to give the patient a chance, and the operation should be performed.

Progressive *heart-failure* is one of the most frequent and perhaps one of the most serious of the conditions which the physician has to combat. As in other specific affections, this is in part due to the prolonged action of the fever and in part is a toxic effect. Alcohol is here our mainstay and can be given freely. Strychnine is most useful and may be given hypodermically in full doses. Whether digitalis is indicated in the failing heart of fevers is not yet settled. Personally, I am by no means convinced that it does good. Hypodermic injections of ether may be resorted to, and are sometimes helpful in tiding the patient over a critical period.

The *nervous symptoms* of typhoid fever are best treated by hydrotherapy. One special advantage of this plan is that the restlessness is allayed, the delirium quieted, and sedatives are rarely needed. In the cases which set in early with severe headache, meningeal symptoms and high fever, the cold bath, or in private practice the cold-pack, should be employed. An ice-cap may be placed on the head, and if necessary morphia administered hypodermically. The practice, in such cases, of applying blisters to the nape of the neck and to the extremities is, to paraphrase Huxham's words, an *unwholesome severity*, which should long ago have been discarded by the profession. For the nocturnal restlessness, so distressing in some cases, Dover's powder should be given. As a rule, if a hypnotic is indicated, it is best to give opium in some form. Pulmonary complications should, if severe, receive appropriate treatment.

In protracted cases very special care should be taken to guard against *bed-sores*. Absolute cleanliness and careful drying of the parts after an evacuation should be enjoined. The patient should be turned from side to side and propped with pillows, and the back can then be sponged with spirits. On the first appearance of a sore, the water or air bed should be used.

(*f*) **The Management of Convalescence.**—With the fall of the temperature to normal in the evening, and the disappearance of the other symptoms, the patient enters upon a stage which is often more difficult to manage than the attack itself. Convalescents from typhoid fever frequently cause greater anxiety than patients in the attack. The question of food has to be met at once, as the patient develops a ravenous appetite and clamors for a fuller diet. My custom has been not to allow solid food until the temperature has been normal for ten days. This is, I think, a safe rule, leaning perhaps to the side of extreme caution; but after all with eggs, milk toast, milk puddings, and jellies, the patient can take a fairly varied diet. Many leading practitioners allow solid food to a patient so soon as he desires it. Peabody gives it on the disappearance of

the fever; the late Austin Flint was also in favor of giving solid food early; and Naunyn, at the Strasburg Medical Clinic, told me that this was his practice. I had an early lesson in this matter which I have never forgotten. A young lad in the Montreal General Hospital, in whose case I was much interested, passed through a tolerably sharp attack of typhoid fever. Two weeks after the evening temperature had been normal, and only a day or two before his intended discharge, he ate several mutton chops, and within twenty-four hours was in a state of collapse from perforation. A small transverse rent was found at the bottom of an ulcer which was in process of healing. It is not easy to say why solid food, particularly meats, should disagree, but in so many instances an indiscretion in diet is followed by slight fever, the so-called *febris carnis*, that it is in the best interests of the patient to restrict the diet for some time after the fever has fallen. An indiscretion in diet may indeed precipitate a relapse. The patient may be allowed to sit up for a short time about the end of the first week of convalescence, and the period may be prolonged with a gradual return of strength. He should move about slowly, and when the weather is favorable should be in the open air as much as possible. The patient should be guarded at this period against all unnecessary excitement. Emotional disturbance not infrequently is the cause of a recrudescence of the fever. Constipation is not uncommon in convalescence and is best treated by enemata. A protracted diarrhœa, which is usually due to ulceration in the colon, may retard recovery. In such cases the diet should be restricted to milk, and the patient should be confined to bed; large doses of bismuth and astringent injections will prove useful.

The recrudescence of the fever does not require special treatment. The treatment of the relapse is essentially that of the original attack.

Among the dangers of convalescence may be mentioned tuberculosis, which is said by Murchison to be more common after this than after any other fever. There are facts in the literature favoring this view, but it is a rare sequence in this country.

II. TYPHUS FEVER.

Definition.—An acute infectious disease characterised by sudden onset, a maculated rash, marked nervous symptoms, and a termination, usually by crisis, about the end of the second week.

Etiology.—The disease has long been known under the names of hospital fever, spotted fever, jail fever, camp fever, and ship fever. In Germany it is known as *exanthematic* typhus, in contradistinction to *abdominal* typhus.

Typhus is now a rare disease. Sporadic cases occur from time to time in the large centres of population, but epidemics are infrequent. In this

country during the past ten years there have been very few outbreaks. In New York in 1881–'82 seven hundred and thirty-five cases were admitted into the Riverside Hospital; in Philadelphia a small epidemic occurred in 1883 at the Philadelphia Hospital.

The special elements in the etiology of typhus are overcrowding and poverty. As Hirsch tersely puts it, "Die Geschichte des Typhus ist die des menschlichen Elends." Overcrowding, lack of cleanliness, intemperance and bad food are predisposing causes. The disease still lurks in the worst quarters of London and Glasgow, and is seen occasionally in New York and Philadelphia. It is more common in Great Britain and Ireland than in other parts of Europe. Murchison held that the disease might originate spontaneously under favorable conditions. This opinion is suggested by the occurrence of local outbreaks under circumstances which render it difficult to explain its importation, but the analogy of other infectious diseases is directly against it. In 1877 there occurred a local outbreak of typhus at the House of Refuge, in Montreal, in which city the disease had not existed for many years. The overcrowding was so great in the basement-rooms of the refuge that at night there were not more than eighty-eight cubic feet of space to each person. Eleven persons were affected. It was not possible to trace the source of infection.

Typhus is one of the most highly contagious of febrile affections. In epidemics nurses and doctors in attendance upon the sick are almost invariably attacked. There is no disease which has so many victims in the profession. In the extensive epidemic in the early and middle part of this century many hundred physicians died in the discharge of their duty. Casual attendance upon cases in limited epidemics does not appear to be very risky, but when cases are aggregated together in wards the poison appears concentrated and the danger of infection is much enhanced. Bedding and clothes retain the poison for a long time.

The microbe of typhus fever has not yet been determined. Hlava found in twenty of thirty-three bodies, and twice during life, a strepto-bacillus, the relation of which to the disease has not yet been determined.

Morbid Anatomy.—The anatomical changes are those which result from intense fever. The blood is dark and fluid, the muscles are of a deep red color and often show a granular degeneration, particularly in the heart; the liver is enlarged and soft and may have a dull clay-like lustre; the kidneys are swollen; there is moderate enlargement of the spleen, and a general hyperplasia of the lymph-follicles. Peyer's glands are not ulcerated. Bronchial catarrh is usually, and hypostatic congestion of the lungs often, present. The skin shows the petechial rash.

Symptoms.—Incubation.—This is placed at about twelve days, but it may be less. There may be ill-defined feelings of discomfort. As a rule, however, the *invasion* is abrupt and marked by chills or a single rigor, followed by fever. The chills may recur during the first few days, and there is headache with pains in the back and legs. There is early pros-

streptobacilli, diplococci and an Ascomycete have been described in the blood & tissues, but question still remains open for investigation

tration, and the patient is glad to take to his bed at once. The temperature is high at first, and may attain its maximum on the second or third day. The pulse is full, rapid, and not so frequently dicrotic as in typhoid. The tongue is furred and white, and there is an early tendency to dryness. The face is flushed, the eyes are congested, the expression is dull and stupid. Vomiting may be a distressing symptom. In severe cases mental symptoms are present from the outset, either a mild febrile delirium or an excited, active, almost maniacal condition. Bronchial catarrh is common.

Stage of Eruption.—From the third to the fifth day the eruption appears—first upon the abdomen and upper part of the chest, and then upon the extremities and face; developing so rapidly that in two or three days it is all out. There are two elements in the eruption: a subcuticular mottling, "a fine, irregular, dusky red mottling, as if below the surface of the skin some little distance, and seen through a semi-opaque medium" (Buchanan); and distinct papular rose-spots which change to petechiæ. In some instances the petechial rash comes out with the rose-spots. Collie describes the rash as consisting of three parts —rose-colored spots which disappear on pressure, dark-red spots which are modified by pressure, and petechiæ upon which pressure produces no effect. In children the rash at first may present a striking resemblance to measles, and give as a whole a curiously mottled appearance to the skin. The term mulberry rash is sometimes applied to it. In mild cases the eruption is slight, but even then is largely petechial in character. As the rash is largely hæmorrhagic, it is permanent and does not disappear after death. Usually the skin is dry, so that sudaminal vesicles are not common. It is stated by some authors that a distinctive odor is present. During the second week the general symptoms are usually much aggravated. The prostration becomes more marked, the delirium more intense, and the fever rises. The patient lies on his back with a dull expressionless face, flushed cheeks, injected conjunctivæ, and contracted pupils. The pulse increases in frequency and is feebler, the face is dusky, and the condition becomes more serious. Retention of urine is common. Coma-vigil is frequent, a condition in which the patient lies with open eyes, but quite unconscious. Subsultus tendinum and picking at the bedclothes are frequently seen. The tongue is dry, brown, and cracked, and there are sordes on the teeth. Respiration is accelerated, the heart's action becomes more and more enfeebled, and death takes place from exhaustion. In favorable cases, about the end of the second week occurs the crisis, in which, often after a deep sleep, the patient awakes feeling much better and with a clear mind. The temperature falls, and although the prostration may be extreme, convalescence is rapid and relapse very rare. This abrupt termination by crisis is in striking contrast to the mode of termination in typhoid fever.

Fever.—The temperature rises steadily during the first four or five

days, and the morning remissions are not marked. The maximum temperature is usually reached by the fifth day, when the temperature may reach 105°, 106°, or 107°. In mild cases it seldom rises above 103°. After reaching its maximum the temperature generally continues with slight morning remissions until the twelfth or fourteenth day, when the crisis occurs, during which the temperature may fall below normal within twelve or twenty-four hours. Preceding a fatal termination, there is usually a rapid rise in the fever to 108° or even 109°.

The heart may early show signs of weakness. The first sound becomes feeble and almost inaudible, and a systolic murmur at the apex is not infrequent. Hypostatic congestion of the lungs occurs in all severe cases.

The brain symptoms are usually more pronounced than in typhoid, and the delirium is more constant.

The urine in typhus shows the usual febrile increase of urea and uric acid. The chlorides diminish or disappear. Albumen is present in a large proportion of the cases, but nephritis seldom occurs.

Variations in the course of the disease are naturally common. There are malignant cases which rapidly prove fatal within two or three days; the so-called *typhus siderans*. On the other hand, during epidemics there are extremely mild cases in which the fever is slight, the delirium absent, and convalescence is established by the tenth day.

Complications and Sequelæ.—Broncho-pneumonia is perhaps the most common complication. It may pass on to gangrene. In certain epidemics gangrene of the toes, the hands, or the nose, and in children noma or cancrum oris, have occurred. Meningitis is rare. Paralyses, which are probably due to the post-febrile neuritis, are not very uncommon. Septic processes, such as parotitis and abscesses in the subcutaneous tissues and in the joints, are occasionally met. Nephritis is rare. Hæmatemesis may occur.

Prognosis.—The mortality ranges in different epidemics from 12 to 20 per cent. It is very slight in the young. Children, who are quite as frequently attacked as adults, rarely die. After middle age the mortality is high, in some epidemics 50 per cent. Death usually occurs toward the close of the second week and is due to the toxæmia. In the third week it is more commonly due to pneumonia.

Diagnosis.—During an epidemic there is rarely any doubt, for the disease presents distinctive general characters. Isolated cases may be very difficult to distinguish from typhoid fever. While in typical instances the eruption in the two affections is very different, yet taken alone it may be deceptive, since in typhoid fever a roseolous rash may be abundant and there is occasionally a subcuticular mottling and even petechiæ. The difference in the onset, particularly in the temperature, is marked; but cases in which it is important to make an accurate diagnosis are not usually seen until the fourth or fifth day. The suddenness of the onset, the greater frequency of the chill, and the early prostration are the distinctive

features in typhus. The brain symptoms too are earlier. It is easy to put down on paper elaborate differential distinctions, which are practically useless at the bedside, particularly when the disease is not prevailing as an epidemic. In sporadic cases the diagnosis is sometimes extremely difficult. I have seen Murchison himself in doubt, and more than once I have known a diagnosis to be deferred until the *sectio cadaveris*. Severe cerebro-spinal fever may closely simulate typhus at the outset, but the diagnosis is usually clear within a few days. Malignant variola also has certain features in common with severe typhus, but the greater extent of the hæmorrhages and the bleeding from the mucous membranes make the diagnosis clear within a short time. The rash at first resembles that of measles, but in this disease the eruption is brighter red in color, often crescentic or irregular in arrangement, and appears first in the face.

The frequency with which other diseases are mistaken for typhus is shown by the fact that during and following the epidemic of 1881 in New York one hundred and eight cases were wrongly diagnosed—one eighth of the entire number—and sent to the Riverside Hospital (F. W. Chapin).

Treatment.—Practically the general management of the disease is like that of typhoid fever. Hydrotherapy should be thoroughly and systematically employed. Judging from the good results which we have obtained by this method in typhoid cases with nervous symptoms much may be expected from it. Certain authorities have spoken against it, but it should be given a more extended trial. Medicinal antipyretics are less suitable than in typhoid, as the tendency to heart-weakness is often more pronounced. As a rule the patients require from the outset a supporting treatment; water should be freely given, and alcohol in suitable doses according to the condition of the pulse.

The bowels may be kept open by mild aperients. The so-called specific medication, by sulphocarbolates, the sulphides, carbolic acid, etc., is not commended by those who have had the largest experience. The special nervous symptoms and the pulmonary symptoms should be dealt with as in typhoid fever. In epidemics, when the conditions of the climate are suitable, the cases are best treated in tents in the open air.

III. RELAPSING FEVER (*Febris recurrens*).

Definition.—A specific infectious disease caused by the spirochæte (spirillum) of Obermeier, characterised by definite febrile paroxysms which usually last six days and are followed by a remission of about the same length of time, then by a second paroxysm, which may be repeated three or even four times, whence the name relapsing fever.

Etiology.—This disease, which has also the names "famine fever" and "seven-day fever," has been known since the early part of the

eighteenth century, and has from time to time extensively prevailed in Europe and in Ireland. It is common in India, where the conditions for its development seem always to be present. The subject has been specially studied by Vandyke Carter, of Bombay. It was first seen in this country in 1844, when cases were admitted to the Philadelphia Hospital, which are described by Meredith Clymer in his work on fevers. Flint saw cases in 1850–'51. In 1869 it prevailed extensively in epidemic form in New York and Philadelphia; since then it has not appeared.

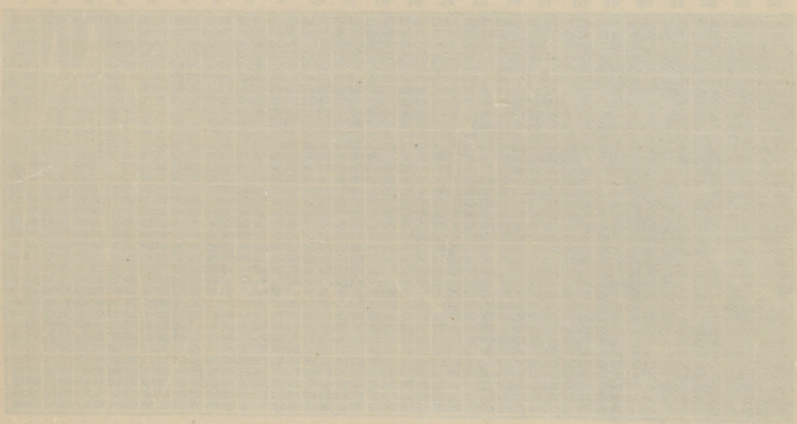
The special conditions under which it develops are very similar to those of typhus fever. Overcrowding and deficient food are the conditions which seem to promote the rapid spread of the virus. Neither age, sex, nor season seems to have any special influence. It is a contagious disease and may be communicated from person to person, but is not so contagious as typhus. Murchison thinks it may be transported by fomites. One attack does not confer immunity from subsequent attacks. In 1873 Obermeier described an organism in the blood which is now recognised as the specific agent. This spirillum, or more correctly spirochæte, is from three to six times the length of the diameter of a red blood-corpuscle, and forms a narrow spiral filament which is readily seen moving among the red corpuscles during a paroxysm. They are present in the blood only during the fever. Shortly before the crisis and in the intervals they are not found, though small glistening bodies, which are stated to be their spores, appear in the blood. The disease has been produced in human beings by inoculation of the blood during the paroxysm. It has also been produced in monkeys. Nothing is yet known with reference to the life history of the spirochæte.

Morbid Anatomy.—There are no characteristic anatomical appearances in relapsing fever. If death takes place during the paroxysm the spleen is large and soft, and the liver, kidneys and heart show cloudy swelling. There may be infarcts in the kidneys and spleen. The bone marrow has been found in a condition of hyperplasia. Ecchymoses are not uncommon.

Symptoms.—*Incubation* appears to be short, and in some instances the attack develops promptly after exposure; more frequently, however, from five to seven days elapse.

The *invasion* is abrupt, with chill, fever, and intense pain in the back and limbs. In young persons there may be nausea, vomiting, and convulsions. The temperature rises rapidly and may reach 104° on the evening of the first day. Sweats are common. The pulse is rapid, ranging from 110 to 130. There may be delirium if the fever is high. Swelling of the spleen can be detected early. Jaundice is common in some epidemics. The gastric symptoms may be severe. There are seldom intestinal symptoms. Cough may be present. Occasionally herpes is noted, and there may be miliary vesicles and petechiæ. During the paroxysm the blood invariably shows the spirochæte. After persisting with severity or even

and where it



The /dc/

which

first paroxysm.

with an increasing intensity for five or six days the crisis occurs. In the course of a few hours, accompanied by profuse sweating, sometimes by diarrhœa, the temperature falls to normal or even subnormal, and the period of apyrexia begins.

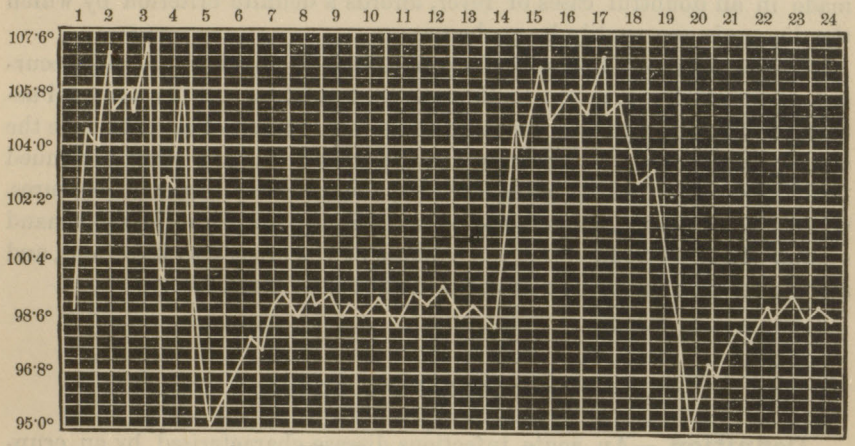


CHART VI.—Relapsing fever (Murchison).

The crisis may occur as early as the third day, or it may be delayed to the tenth; it usually comes, however, about the end of the first week. In delicate and elderly persons there may be collapse. The convalescence is rapid, and in a few days the patient is up and about. Then in a week, usually on the fourteenth day, he again has a rigor, or a series of chills; the fever returns and the attack is repeated. A second crisis occurs from the twentieth to the twenty-third day, and again the patient recovers rapidly. As a rule the relapse is shorter than the original attack. A second and a third may occur, and there are instances on record of even a fourth and a fifth. In epidemics there are cases terminating by crisis on the seventh or eighth day without the occurrence of relapse. In protracted cases the convalescence is very tedious, as the patient is much exhausted.

Relapsing fever is not a very fatal disease. Murchison states that the mortality is about 4 per cent. In the enfeebled and old, death may occur at the height of the original attack.

Complications are not frequent. In some epidemics nephritis and hæmaturia have occurred. Pneumonia appears to be frequent and may interrupt the typical course of the disease. The acute enlargement of the spleen may end in rupture, and the hæmorrhage from the stomach which has been met with occasionally is probably associated with this enlargement. Post-febrile paralyses may occur. Ophthalmia has followed certain epidemics, and may prove a very tedious and serious complication. Jaundice has already been mentioned. In pregnant women abortion usually takes place.

Diagnosis.—The onset and general symptoms may not at first be distinctive. At the beginning of an epidemic the cases are usually regarded as anomalous typhoid; but once the typical course is followed in a case the diagnosis is clear. The blood examination, which should be made in all doubtful cases of fever, affords a definite criterion by which the diagnosis can readily be made.

Treatment.—The paroxysm can neither be cut short nor its recurrence prevented. It might be thought that quinine, with its powerful action, would certainly meet the indications, but it does not seem to have the slightest influence. The disease must be treated like any other continued fever by careful nursing, a regular diet, and ordinary hygienic measures. Of special symptoms, pains in the back and in the limbs and joints demand opium. In enfeebled persons the collapse at the crisis may be serious, and stimulants with ammonia and digitalis should be given freely.

IV. SMALL-POX (*Variola*).

Definition.—An acute infectious disease characterised by an eruption which passes through the stages of papule, vesicle, pustule and crust. The mucous membranes in contact with the air may also be affected. Severe cases may be complicated with cutaneous and visceral hæmorrhages.

Etiology.—It has not yet been determined in what country small-pox originated. The disease is said to have existed in China many centuries before Christ. The *pesta magna* described by Galen (and of which Marcus Aurelius died) is believed to be small-pox. In the sixth century it prevailed, and subsequently, at the time of the Crusades, became widespread. It was brought to America by the Spaniards early in the sixteenth century. The first accurate account was given by Rhazes, an Arabian physician who lived in the ninth century, and whose admirable description is available in Greenhill's translation for the Sydenham Society. In the seventeenth century a thorough study of the disease was made by the illustrious Sydenham, who still remains one of the most trustworthy authorities on the subject.

Special events in the history of the disease are the introduction of inoculation into Europe, by Lady Mary Wortley Montagu, in 1718, and the discovery of vaccination by Jenner, in 1798.

Small-pox is one of the most virulent of contagious diseases, and persons exposed, if unprotected by vaccination, are almost invariably attacked. There are instances on record of persons insusceptible to the disease. It is said that Diemerbrock, a celebrated Utrecht professor in the seventeenth century, was not only himself exempt, but likewise many members of his family. One of the nurses in the small-pox department of the Montreal General Hospital stated that she had never been successfully vaccinated,

An attack may not ~~confer~~ protect for life. There are undoubted cases of a second, reputed instances indeed of a third, attack

and the mortality is greater ~~about~~ 42 % against 29 per cent. in the white. (W. M. Welch)

and she certainly had no mark. Such instances, however, of natural immunity are very rare.

Age.—Small-pox is common at all ages, but is particularly fatal to young children; thus, in the Montreal epidemic of 1885, 86 per cent of the deaths were of children under ten years of age. The *fœtus in utero* may be attacked, but only if the mother herself is the subject of the disease. The child may be born with the rash out or with the scars. More commonly the fœtus is not affected, and children born in a small-pox hospital, if vaccinated immediately, may escape the disease; usually, however, they die early.

Sex.—Males and females are equally affected.

Race.—Among aboriginal races small-pox is terribly fatal. When the disease was first introduced into America the Mexicans died by thousands, and the North American Indians have also been frequently decimated by this plague. It is stated that the negro is especially susceptible.

The Contagium develops in the system of the small-pox patient and is reproduced in the pustules. It exists in the secretions and excretions, and in the exhalations from the lungs and the skin. The dried scales constitute by far the most important element, and as a dust-like powder are distributed everywhere in the room during convalescence, becoming attached to clothing and various articles of furniture. The disease is probably contagious from a very early stage, though I think it has not yet been determined whether the contagion is active before the eruption develops. The poison is of unusual tenacity and clings to infected localities. It is conveyed by persons who have been in contact with the sick and by fomites. During epidemics it is no doubt widely spread in street-cars and public conveyances. It must not be forgotten that an unprotected person may contract a very virulent form of the disease from the mild varioloid.

The disease smoulders here and there in different localities, and when conditions are favorable becomes epidemic. Perhaps the most remarkable instance in modern times of the rapid extension of the disease occurred in Montreal in 1885. Small-pox had been prevalent in that city between 1870 and 1875, when it died out, in part owing to the exhaustion of suitable material and in part owing to the introduction of animal vaccination. The health reports show that the city was free from the disease until 1885. During these years vaccination, to which many of the French Canadians are opposed, was much neglected, so that a large unprotected population grew up in the city. On February 28th a Pullman-car conductor, who had travelled from Chicago, where the disease had been slightly prevalent, was admitted into the Hôtel-Dieu, the civic small-pox hospital being at the time closed. Isolation was not carried out, and on the 1st of April a servant in the hospital died of small-pox. Following her decease, with a negligence absolutely criminal, the authorities of the hospital dismissed all patients presenting no symptoms of contagion, who could go home. The

disease spread like fire in dry grass, and within nine months there died in the city, of small-pox, 3,164 persons.

The nature of the contagion of small-pox is still unknown. Weigert and others have described micro-organisms in the pock, but they are the ordinary pus cocci, and the part which they play in the affection is by no means certain. Still less definite are the observations on the occurrence of sporozoa in the pocks. It is not a little remarkable that in a disease which is rightly regarded as the type of all infectious maladies, the specific virus still remains unknown.

Morbid Anatomy.—A section of a papule as it is passing into the vesicular stage shows in the *rete mucosum*, close to the true skin, an area in which the cells are smooth, granular, and do not take the staining fluid. This represents a focus of coagulation-necrosis due, according to Weigert, to the presence of micrococci. Around this area there is active inflammatory reaction, and in the vesicular stage the rete mucosum presents reticuli, or spaces, which contain serum, leucocytes and fibrin filaments. The central depression or umbilication corresponds to the area of primary necrosis. In the stage of maturation the reticular spaces become filled with leucocytes and many of the cells of the rete mucosum become vesicular. The papillæ of the true skin below the pustule are swollen and infiltrated with embryonic cells to a variable degree. If the suppuration extends into this layer, scarring inevitably results; but if it is confined to the upper layer, it does not necessarily follow. In the hæmorrhagic cases, red corpuscles pass out in large numbers from the vessels and occupy the vesicular spaces. They infiltrate also the deeper layers of the epidermis in the skin adjacent to the papules. Frequently a hair-follicle passes through the centre of a papule.

In the mouth the pustules may be seen upon the tongue and the buccal mucosa, and on the palate. The eruption may be abundant also in the pharynx and the upper part of the œsophagus. In exceptionally rare cases the eruption extends down the œsophagus and even into the stomach. Swelling of the Peyer's follicles is not uncommon; the pustules have been seen in the rectum.

In the larynx the eruption may be associated with a fibrinous exudate and sometimes with œdema. Occasionally the inflammation passes deeply and involves the cartilages. In the trachea and bronchi there may be ulcerative erosions, but true pocks, such as are seen on the skin, do not occur. There are no special lesions of the lungs, but congestion and broncho-pneumonia are very common. The liver is sometimes fatty. A diffuse hepatitis, associated with intense congestion of the vessels and migration of the leucocytes, has been described; Weigert has noted small areas of necrosis.

There is nothing special in the condition of the blood, and even in the most malignant cases there are no microscopic alterations. In the blood-drop, however, it will be seen that the corpuscles, instead of forming

"from nine to fifteen days; usually twelve"

rouleaux, aggregate together in irregular clumps. The heart occasionally shows myocardial changes, parenchymatous and fatty; endocarditis and pericarditis are uncommon. French writers have described an endarteritis of the coronary vessels in connection with small-pox. The spleen is markedly enlarged. Apart from the cloudy swelling and areas of coagulation-necrosis, lesions of the kidneys are not common. Nephritis may occur during convalescence. Chiari has called attention to the frequency of orchitis in this disease. There are scattered areas of necrosis with cell infiltration.

In the hæmorrhagic form extravasations are found on the serous and mucous surfaces, in the parenchyma of organs, in the connective tissues, and about the nerve-sheaths. In one instance I found the entire retroperitoneal tissue infiltrated with a large coagulum, and there were also extensive extravasations in the course of the thoracic aorta. Hæmorrhages in the bone-marrow have also been described by Golgi. There may be hæmorrhages into the muscles. Ponfick has described the spleen as very firm and hard in hæmorrhagic small-pox, and such was the case in seven instances which I examined. The liver has been described as fatty in these rapid cases, but in five of my seven cases it was of normal size, dense, and firm. In two it was large and fatty; but one man had necrosis of the tibia, and the other was a drunkard. The ecchymoses are scattered over the meninges of the brain and cord, and in one case there was a clot in the right ventricle. In five of the cases there were areas of hæmorrhagic infarction of the lung. In four instances the pelves of the kidney were blocked with dark clots, which extended into the calices and down the ureters. In one instance the coats of the bladder were uniformly hæmorrhagic and not a trace of normal tissue could be seen. The extravasations in the mucous membrane of the stomach and intestines were numerous and large. Peyer's glands were swollen and prominent in four instances.

Symptoms.—Three forms of small-pox are described:

1. *Variola vera;* (*a*) Discrete, (*b*) Confluent.

2. *Variola hæmorrhagica;* (*a*) Purpura variolosa or black small-pox; (*b*) Hæmorrhagic pustular form, variola hæmorrhagica pustulosa.

3. *Varioloid*, or small-pox modified by vaccination.

1. **Variola Vera.**—The affection may be conveniently described under various stages: (*a*) *Incubation.* ~~This is variously estimated at from seven to twelve days, or even longer.~~ I have seen it develop on the eighth day after exposure to infection, and there are well-authenticated instances in which the stage of incubation has been prolonged to twenty days. It is unusual for patients to complain of any symptoms in this stage.

(*b*) *Invasion.*—In adults a chill and in children a convulsion are common initial symptoms. There may be repeated chills within the first twenty-four hours. Intense frontal headache, severe lumbar pains and vomiting are very constant features. The pains in the back and in the

limbs are more severe in the initial stage of this than of any other eruptive fever, and their combination with headache and vomiting is so sug-

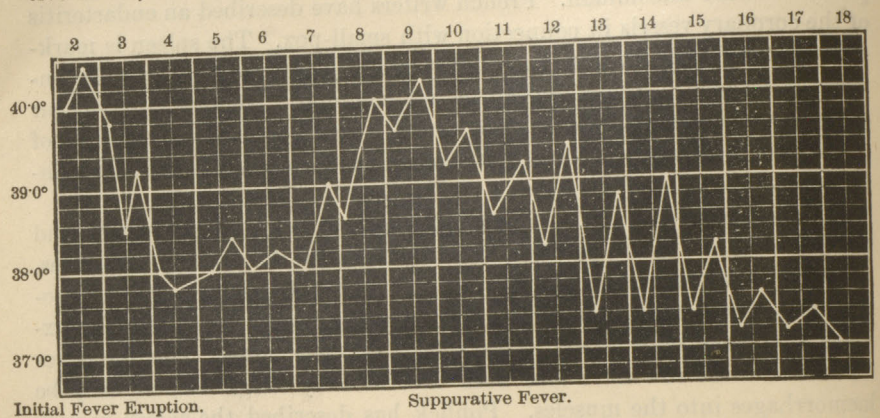


CHART VII.—True small-pox.

gestive that in epidemics precautionary measures may often be taken several days before the eruption decides positively the nature of the disease. The temperature rises quickly, and may on the first day be 103° or 104°. The pulse is rapid and full, not often dicrotic. In severe cases there may be marked delirium, particularly if the fever is high. The patient is restless and distressed, the face is flushed, and the eyes are bright and clear. The skin is usually dry, though occasionally there are profuse sweats. One cannot judge from these initial symptoms whether a case is likely to be discrete or confluent, as the most intense backache and fever may precede a very mild attack. Convulsions are not uncommon in children.

In this stage of invasion the so-called initial rashes may occur, of which two forms can be distinguished—the diffuse, scarlatinal, and the macular or measly form; either of which may be associated with petechiæ and occupy a variable extent of surface. In some instances they are general, but as a rule they are limited, as pointed out by Simon, either to the lower abdominal areas, to the inner surfaces of the thighs, and to the lateral thoracic region or to the axillæ. Occasionally they are found over the extensor surfaces, particularly in the neighborhood of the knees and elbows. These rashes, usually purpuric, are often associated with an erythematous or erysipelatous blush. The scarlatinal rash may come out as early as the second day and be as diffuse and vivid as in a true scarlatina. The measly rash may also be diffuse and identical in character with that of measles. Urticaria is only occasionally seen. It was present once in my Montreal cases. Apparently these initial rashes are more abundant in some epidemics than in others; thus they were certainly more numerous in the Montreal epidemics between 1870 and 1875 than they were in the more extensive epidemic in 1885. They occur in from 10 to 16 per cent

of cases. In the cases under my care in the small-pox department at the Montreal General Hospital the percentage was 13.* As will be subsequently mentioned these initial rashes have considerable diagnostic value.

(*c*) *Eruption.*—(1) In the *discrete form*, usually on the fourth day, small red spots appear on the forehead, particularly at the junction with the hair, and on the wrists. Within the first twenty-four hours from their appearance they occur on other parts of the face and on the extremities, and a few are seen on the trunk. As the rash comes out the temperature falls, the general symptoms subside, and the patient feels comfortable. On the fifth or sixth day the papules change into vesicles with clear summits. Each one is elevated, circular, and presents a little depression in the centre, the so-called umbilication. About the eighth day the vesicles change into pustules, the umbilication disappears, the flat top assumes a globular form and becomes grayish yellow in color, owing to the contained pus. There is an areola of injection about the pustules and the skin between them is swollen. This maturation first takes place on the face, and follows the order of the appearance of the eruption. The temperature now rises—secondary fever—and the general symptoms return. The swelling about the pustules is attended with a good deal of tension and pain in the face; the eyelids become swollen and closed. In the discrete form the temperature of maturation does not usually remain high for more than twenty-four or twenty-six hours, so that on the tenth or eleventh day the fever disappears and the stage of convalescence begins. The pustules rapidly dry, first on the face and then on the other parts, and by the fourteenth or fifteenth day desquamation may be far advanced on the face. There may be in addition vesicles in the mouth, pharynx, and larynx, causing soreness and swelling in these parts, with loss of voice. Whether pitting takes place depends a good deal upon the severity of the disease. In a majority of cases Sydenham's statement holds good, that "it is very rarely the case that the distinct small-pox leaves its mark."

(2) *The Confluent Form.*—With the same initial symptoms, though usually of greater severity, the rash appears on the fourth, or, according to Sydenham, on the third day. The more the eruption shows itself before the fourth day, the more sure it is to become confluent (Sydenham). The papules at first may be isolated and it is only later in the stage of maturation that the eruption is confluent. But in severer cases the skin is swollen and hyperæmic and the papules are very close together. On the feet and hands, too, the papules are thickly set; more scattered on the limbs; and quite discrete on the trunk. With the appearance of the eruption the symptoms subside and the fever remits, but not to the same extent as in the discrete form. Occasionally the temperature falls to normal and the patient may be very comfortable. Then, usually on the eighth day, the temperature again rises, the vesicles begin to change to

* The Initial Rashes of Small-pox. Canada Medical and Surgical Journal, 1875.

pustules, the hyperæmia about them becomes intense, the swelling of the face and hands increases, and by the tenth day the pustules have fully maturated, many of them have coalesced and the entire skin of the head and extremities is a superficial abscess. The fever rises to 103° or 104°, the pulse is from 110 to 120, and there is often delirium. As pointed out by Sydenham, salivation in adults and diarrhœa in children are common symptoms of this stage. There is usually much thirst. The eruption may also be present in the mouth, and usually the pharynx and larynx are involved and the voice is husky. Great swelling of the cervical lymphatic glands occurs. At this stage the patient presents a terrible picture, unequalled in any other disease; one which fully justifies the horror and fright with which small-pox is associated in the public mind. Even when the rash is confluent on the face, hands, and feet, the pustules remain discrete on the trunk. The danger, as pointed out by Sydenham, is in proportion to the number upon the face. "If upon the face they are as thick as sand it is no advantage to have them few and far between on the rest of the body." In fatal cases, by the tenth or eleventh day the pulse gets feebler and more rapid, the delirium is marked, there is subsultus, sometimes diarrhœa, and with these symptoms the patient dies. In other instances between the eighth and eleventh day hæmorrhagic symptoms develop. When recovery takes place, the patient enters on the eleventh or twelfth day the period of—

(*d*) *Desiccation.*—The pustules break and the pus exudes and forms crusts. Throughout the third week the desiccation proceeds and in cases of moderate severity the secondary fever subsides; but in others it may persist until the fourth week. The crusts in confluent small-pox adhere for a long time and the process of scarring may take three or four weeks. The crusts on the face fall off, but the tough epidermis of the hands and feet may be shed entire. We had in the small-pox department of the Montreal General Hospital several moulds in epithelium of the hands and feet.

2. **Hæmorrhagic small-pox** occurs in two forms. In one the special symptoms appear early and death follows in from two to six days. This is the so-called petechial or black small-pox—*purpura variolosa.* In the other form the case progresses as one of ordinary variola, and it is not until the vesicular or pustular stage that hæmorrhage takes place into the pocks or from the mucous membranes. This is sometimes called *variola hæmorrhagica pustulosa.*

Hæmorrhagic small-pox is more common in some epidemics than in others. It is less frequent in children than in adults. Of twenty-seven cases admitted to the small-pox department of the Montreal General Hospital there were three under ten years, four between fifteen and twenty, nine between twenty and twenty-five, seven between twenty-five and thirty-five, three between thirty-five and forty-five, and one above fifty. Young and vigorous persons seem more liable to this form. Several of my cases were above the average in muscular development. Men are more fre-

quently affected than women; thus in my list there were twenty-one males and only six females. The influence of vaccination is shown in the fact that of the cases fourteen were unvaccinated, while not one of the thirteen who had scars had been revaccinated.

The clinical features of the forms of hæmorrhagic small-pox are somewhat different.

In *purpura variolosa* the illness starts with the usual symptoms, but with more intense constitutional disturbance. On the evening of the second or on the third day there is a diffuse hyperæmic rash, particularly in the groins, with small punctiform hæmorrhages. The rash extends, becomes more distinctly hæmorrhagic, and the spots increase in size. Ecchymoses appear on the conjunctivæ, and as early as the third day there may be hæmorrhages from the mucous membranes. Death may take place before the rash appears. This is truly a terrible affection and well developed cases present a frightful appearance. The skin may have a uniformly purplish hue and the unfortunate victim may even look plum-colored. The face is swollen and large conjunctival hæmorrhages with the deeply sunken corneæ give a ghastly appearance to the features.

The mind may remain clear to the end. Death occurs from the third to the sixth day; thus in thirteen of my cases death took place on or before this date. The earliest death was on the third day and there were no traces of papulæ. There may be no mucous hæmorrhages; thus in one case of a most virulent character death occurred without bleeding early on the fourth day. Hæmaturia is perhaps most common, next hæmatemesis, and melæna was noticed in a third of the cases. Metrorrhagia was noticed in one only of the six females on my list. Hæmoptysis occurred in five cases. The pulse in this form of small-pox is rapid and often hard and small. The respirations are greatly increased in frequency and out of all proportion to the intensity of the fever. In the case of a negro, whose respirations the morning after admission were 52 and temperature 101°, after examining the lungs and finding nothing to account for the increased breathing, my suspicions were aroused, and even on the dark skin I was able on careful inspection to detect hæmorrhages in and about the papulæ.

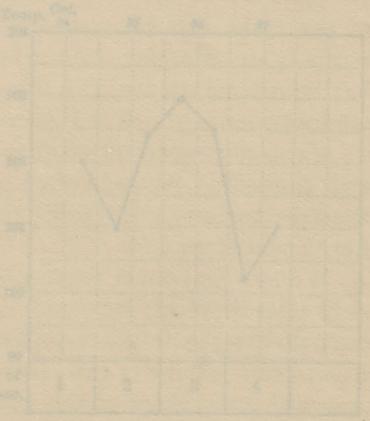


CHART VIII.—Hæmorrhagic small-pox.

The annexed chart is from a case of malignant small-pox which came on abruptly on Thursday, October 24, 1872, and which terminated fatally on the fourth day. It shows the moderate temperature range.

quently affected than women; thus in my list there were twenty-one males and only six females. The influence of vaccination is shown in the fact that of the cases fourteen were unvaccinated, while not one of the thirteen who had scars had been revaccinated.

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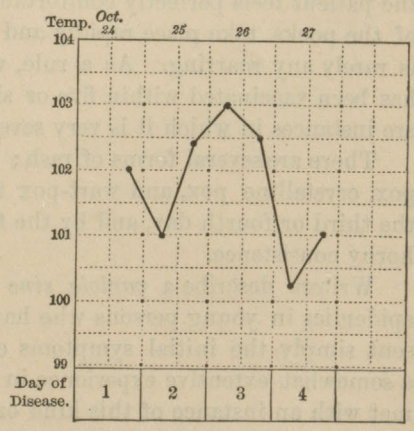


CHART VIII.—Hæmorrhagic small-pox.

The annexed chart is from a case of malignant small-pox which came on abruptly on Thursday, October 24, 1874, and which terminated early on the fourth day. It shows the moderate temperature range.

In *variola pustulosa hæmorrhagica* the disease progresses as an ordinary case of severe variola, and the hæmorrhages do not develop until the vesicular or pustular stage. The earlier the hæmorrhage the greater is the danger. There are undoubtedly instances of recovery when the bleeding has taken place at the stage of maturation. Bleeding from the mucous membranes is also common in this form, and the great majority of the cases prove fatal, usually on the seventh, eighth, or ninth day.

There is a form of hæmorrhagic small-pox in which bleeding takes place into the pocks in the vesicular stage and is followed by a rapid abortion of the rash and a speedy recovery. Six instances of this kind came under my observation.* In four the hæmorrhage took place on the fourth day; in two on the fifth day, just at the time of transition of the papule into the vesicle. Extravasation takes place chiefly into the pocks on the lower extremities and trunk, in only two instances occurring in those of the arms. The eruption in all proved abortive, and no patients under my care with an equal extent of eruption made such rapid recoveries. With these cases are to be grouped those in which the hæmorrhages occur in the pustules of the legs in patients who have in their delirium got out of bed and wandered about. This modified form of hæmorrhagic small-pox is also described by Scheby-Buck.

3. **Varioloid.**—This term is applied to the modified form of small-pox which affects persons who have been vaccinated. It may set in with abruptness and severity, the temperature reaching 103°. More commonly it is in every respect milder in its initial symptoms, though the headache and backache may be very distressing. The papules appear on the evening of the third or on the fourth day. They are few in number and may be confined to the face and hands. The fever drops at once and the patient feels perfectly comfortable. The vesiculation and maturation of the pocks take place rapidly and there is no secondary fever. There is rarely any scarring. As a rule, when small-pox attacks a person who has been vaccinated within five or six years the disease is mild, but there are instances in which it is very severe, and it may even prove fatal.

There are several forms of rash; thus in what has been known as horn-pox, crystalline pox, and wart-pox the papules come out in numbers on the third or fourth day, and by the fifth or sixth day have dried to a hard, horny consistence.

Writers describe a *variola sine eruptione*, which is met with during epidemics in young persons who have been well vaccinated, and who present simply the initial symptoms of fever, headache and backache. In a somewhat extensive experience in Montreal I do not remember to have met with an instance of this kind or to have heard of one.

We do not now see the modified form of small-pox, resulting from inoculation, in which by the seventh or eighth day a pustule forms at the

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* Clinical Notes on Small-pox. Montreal, 1876.

and may pass on to suppuration.

seat of inoculation; then general fever sets in, and with it, about the eleventh day, a general eruption, usually limited in degree.

Complications.—Considering the severity of many of the cases and the general character of the disease, associated with multiple foci of suppuration, the complications in small-pox are remarkably few.

Laryngitis is serious in three ways: it may produce a fatal œdema of the glottis; it is liable to extend and involve the cartilages, producing necrosis; and by diminishing the sensibility of the larynx, it allows irritating particles to reach the lower air-passages, where they excite bronchitis or broncho-pneumonia.

Broncho-pneumonia is indeed one of the most common complications, and is almost invariably present in fatal cases. Lobar pneumonia is rare. Pleurisy is common in some epidemics.

The cardiac complications are also rare. In the height of the fever a systolic murmur at the apex is not uncommon; but endocarditis, either simple or malignant, is rarely met with. Pericarditis too is very uncommon. Myocarditis seems to be more frequent, and may be associated with endarteritis of the coronary vessels.

Of complications in the digestive system, parotitis is rare. In severe cases there is extensive pseudo-diphtheritic angina. Vomiting, which is so marked a symptom in the early stage, is rarely persistent. Diarrhœa is not uncommon, as noted by Sydenham, and is very constantly present in children.

Albuminuria is frequent, but true nephritis is rare. Inflammation of the testes and of the ovaries may occur.

Among the most interesting and serious complications are those pertaining to the nervous system. In children convulsions are common. In adults the delirium of the early stage may persist and become violent, and finally subside into a fatal coma. Post-febrile insanity is occasionally met with during convalescence, and very rarely epilepsy. Many of the old writers spoke of paraplegia in connection with the intense backache of the early stage, but it is probably associated with the severe agonising lumbar and crural pains and is not a true paraplegia. It must be separated from the form occurring in convalescence, which may be due to peripheral neuritis or to a diffuse myelitis (Westphal). The neuritis may as in diphtheria involve the pharynx alone, or it may be multiple. Of this nature, in all probability, is the so-called pseudo-tabes, or *ataxie-variolique*. Hemiplegia and aphasia have been met with in a few instances, the result of encephalitis.

Among the most constant and troublesome complications of small-pox are those involving the skin. During convalescence boils are very frequent and may be severe. Acne and ecthyma are also met with. Local gangrene in various parts may occur.

Arthritis may develop, usually in the period of desquamation. ~~It is~~

~~probably not a genuine rheumatism.~~ Acute necrosis of the bone is sometimes met with.

Special Senses.—The eye affections which were formerly so common and serious are not now so frequent, owing to the care which is given to keeping the conjunctivæ clean. A catarrhal and purulent conjunctivitis is common in severe cases. The secretions cause adhesions of the eyelids, and unless great care is taken a diffuse keratitis is excited, which may go on to ulceration and perforation. Iritis is not very uncommon. Otitis media is an occasional complication, and usually results from an extension of disease through the Eustachian tubes.

Prognosis.—In unprotected persons small-pox is a very fatal disease. In different epidemics the death-rate is from 25 to 35 per cent. The hæmorrhagic form is invariably fatal, and a majority of those attacked with the severer confluent forms die. In young children it is particularly fatal. In the Montreal epidemic of 1885 and 1886, of 3,164 deaths there were 2,717 under ten years. The intemperate and debilitated succumb more readily to the disease. As Sydenham observed, the danger is directly proportionate to the intensity of the disease on the face and hands. "When the fever increases after the appearance of the pustules, it is a bad sign; but, if it is lessened on their appearance, that is a good sign" (Rhazes). In the confluent cases, when maturation does not proceed and the pocks are flat and if hæmorrhage occurs, the outlook is usually bad. In such cases the general symptoms are apt to be severe. Very high fever, with delirium and subsultus, are symptoms of ill omen. The disease is particularly fatal in pregnant women and abortion usually takes place. It is not, however, uniformly fatal, and I have twice known severe cases to recover after miscarriage. Moreover, abortion is not inevitable. Very severe pharyngitis and laryngitis are fatal complications.

Death results in the early stage from the action of the poison upon the nervous system. In the later stages it usually occurs about the eleventh or twelfth day, at the height of the eruption. In children, and occasionally in adults, the laryngeal and pulmonary complications prove fatal.

Diagnosis.—During an epidemic, the initial chill, followed by fever, headache, vomiting, and the severe pain in the back, are symptoms which should put the attending physician on his guard. Mistakes arise in the initial stage owing to the presence of the scarlatinal or measly rashes which may be extremely deceptive. The scarlatinal rash has not always the intensity of the true rash of this disease. In my Montreal experience I did not meet with an instance in which this rash led to an error, though I heard of several cases in which the mistake was made. These are doubtless the instances to which the older writers refer of scarlet fever and small-pox occurring together. The measly rash cannot always be distinguished from true measles, instances of which may be mistaken for the initial rash. I found in the ward one morning a young man who had been sent in on the previous evening with a diagnosis of small-pox. He

In Dr. Welch's report from the Municipal Hospital Philadelphia of 2831 cases of variola 1,534 i.e. 54.18 per cent died. while of 2,169 cases of varioloid only 28, i.e. 1.29 per cent. died.

had a fading macular rash with distinct small papules, which had not however the shotty hardness of variola. In the evening this rash was less marked, and as I felt sure that a mistake had been made, he was disinfected and sent home. In another instance a child believed to have small-pox was admitted, but it proved to have simply measles. Neither of these cases took small-pox. In a third case, which I saw at the City Hospital, the mottled papular rash was mistaken for small-pox and the young man sent to the hospital. I saw him the day after admission, when there was no question that the disease was measles and not variola. Less fortunate than the other cases, he took small-pox in a very severe form. The general condition of the patient and the nature of the prodromal symptoms are often better guides than the character of the rash. In any case it is not well, as a rule, to send a patient to a small-pox hospital until the characteristic papules appear about the forehead and on the wrists.

In the most malignant type of hæmorrhagic small-pox the patient may die before the characteristic rash develops, though as a rule small, shotty papules may be felt about the wrists or at the roots of the hair. In only one of twenty-seven cases of hæmorrhagic small-pox, in which death occurred on the third day, did inspection fail to reveal the papules. In three cases in which death took place on the fourth day the characteristic rash was beginning to appear.

The disease may be mistaken for cerebro-spinal fever, in which purpuric symptoms are not uncommon. A four-year-old child was taken suddenly ill with fever, pains in the back and head, and on the second or third day petechiæ appeared on the skin. There was retraction of the head, and marked rigidity of the limbs. The hæmorrhages became more abundant; and finally hæmatemesis occurred and the child died on the sixth day. At the post-mortem there were no lesions of cerebro-spinal fever and in the deeply hæmorrhagic skin the papules could be readily seen. The post-mortem diagnosis of small-pox was unhappily confirmed by the mother taking the disease and dying of it.

It might be thought scarcely possible to mistake any other disease for small-pox in the pustular stage. Yet I had an instance of a young man sent to me with a copious pustular eruption, chiefly on the trunk and covered portions of the body, which, so far as the pustules themselves were concerned, was almost identical with that of variola; but the history and the distribution left no question that it was a pustular syphilide. It is not to be forgotten, however, that fever, which was absent in this case, may be present in certain instances of diffuse pustular syphilis. Lastly, chicken-pox and small-pox may be confounded. Indeed, sometimes it is not easy to distinguish between them, though in well-defined cases of varicella the more vesicular character of the pustules, their irregularity, the short stage of invasion, the slight constitutional disturbance, and the greater intensity of the rash on the trunk, should make the diagnosis clear. It is stated that the Chicago case, which was the starting-point in Montreal of the

epidemic of 1885, was regarded as varicella and not isolated. If so, the mistake was one which led to one of the most fatal of modern outbreaks of the disease.

Glanders in the pustular form has been mistaken for small-pox, and I know of an instance (during an epidemic) which was isolated on the supposition that it was variola.

Treatment.—In the interests of public health cases of small-pox should invariably be removed to special hospitals, since it is impossible to take the proper precautions in private houses. The general hygienic arrangements of the room should be suitable for an infectious disease. All unnecessary furniture and the curtains and carpets should be removed. The greatest care should be taken to keep the patient thoroughly clean, and the linen should be frequently changed. The bedclothing should be light. It is curious that the old-fashioned notion, which Sydenham tried so hard to combat, that small-pox patients should be kept hot and warm, still prevails; and I have frequently had to protest against the patient being, as Sydenham expresses it, stifled in his bed. Special care should be taken to sterilize thoroughly everything that has been in contact with the patient.

In the early stage the pain in the back and limbs requires opium, which, as advised by Sydenham, may be freely given. The diet should consist of milk and broths, and of "all articles which give no trouble to digestion." Cold drinks may be freely given. Barley-water and the Scotch borse (oatmeal and water) are both nutritious and palatable. After the preliminary vomiting, which is often very hard to check by ordinary measures, the appetite is usually good, and, if the throat is not very sore, patients with the confluent form take nourishment well. In the hæmorrhagic cases the vomiting is usually aggravating and persistent.

The fever when high must be kept within limits, and it is best to use either cold sponging or the cold bath. When the pyrexia is combined with delirium and subsultus, the patient should be placed in a bath at 70°, and this repeated as often as every three hours if the temperature rises above 103°. When it is not practicable to give the cold bath, the cold pack can be employed. These measures are much preferable in small-pox to the administration of medicinal antipyretics.

The treatment of the eruption has naturally engaged the special attention of the profession. The question of the preventing of pitting, so much discussed, is really not in the hands of the physician. It depends entirely upon the depth to which the individual pustules reach. After trying all sorts of remedies, such as puncturing the pustules with nitrate of silver, or treating them with iodine and various ointments, I came to Sydenham's conclusion that in guarding the face against being disfigured by the scars "the only effect of oils, liniments, and the like, was to make the white scurfs slower in coming off." There is, I believe, something in protecting

the ripening papules from the light, and the constant application on the face and hands of lint soaked in cold water, to which antiseptics such as carbolic acid or bichloride may be added, is perhaps the most suitable treatment. It is very pleasant to the patient, and for the face it is well to make a mask in lint, which can then be covered with oiled silk. When the crusts begin to form, the chief point is to keep them thoroughly moist, which may be done by oil or glycerin. This prevents the desiccation and diffusion of the flakes of epidermis. Vaseline is particularly useful, and at this stage may be freely used upon the face. It frequently relieves the itching also. For the odor, which is sometimes so characteristic and disagreeable, the dilute carbolic solutions are probably best. If the eruption is abundant on the scalp, the hair should be cut short to prevent matting and decomposition of the crusts. During convalescence frequent bathing is advisable, because it helps to soften the crusts. The care of the eyes is particularly important. The lids should be thoroughly cleansed three or four times a day, and the conjunctivæ washed with some antiseptic solution. In the confluent cases, when the eyelids are much swollen and the lids glued together, it is only by watchfulness that keratitis can be prevented. The mouth and throat should be kept clean, and if crusts form in the nose they should be softened by frequent injections. Ice can be given, and is very grateful when there is much angina. In moderate cases, so soon as the fever subsides the patient should be allowed to get up, a practice which Sydenham warmly urged. The diarrhœa, when severe, should be checked with paregoric. When the pulse becomes feeble and rapid, stimulants may be freely given. The delirium is occasionally maniacal and may require chloroform, but for the nervous symptoms the bath or cold pack is the best. For the severe hæmorrhages of the malignant cases nothing can be done, and it is only cruel to drench the unfortunate patient with iron, ergot, and other drugs. Symptoms of obstruction in the larynx, usually from œdema, may call for tracheotomy. In the late stages of the disease, should the patient be extremely debilitated and the subject of abscesses and bed-sores, he may be placed on a water-bed or treated by the continuous warm bath. During convalescence the patient should bathe daily and use carbolic soap freely in order to get rid of the crusts and scabs. The patient should not be considered free from danger to others until the skin is perfectly smooth and clean, and free from any trace of scabs. I have not mentioned any of the so-called specifics or the internal antiseptics, which have been advised in such numbers; because, so far as I know, the experience of those who have seen the most of the disease does not favor their use.

V. VACCINIA (*Cow-pox*)—VACCINATION.

Definition.—An eruptive disease of the cow, the virus of which, inoculated into man (vaccination), produces a local pock with constitutional disturbance, which affords protection, more or less permanent, from small-pox.

The vaccine is got either directly from the calf—animal lymph—in which the disease is propagated at regular stations, or is obtained from persons vaccinated (humanised lymph).

It was in 1798 that Edward Jenner, a friend and pupil of Hunter, practising in Gloucestershire, announced that persons accidentally inoculated with the cow-pox were subsequently insusceptible to small-pox. From that time the process has extended over the civilized world and proved an incalculable boon to humanity. For many years arm-to-arm vaccination was practised, or the lymph was collected from the vesicle of a child, or the dried scabs were used. The humanised lymph in all probability underwent changes and was certainly more frequently followed by evil results. Of late years animal vaccination has superseded it in great part, and now the lymph is derived either directly from the calf or from one or two removes.

The precise nature of the vaccination virus is as yet unknown. Several forms of micro-organisms have been isolated, and Quist has cultivated micrococci which, he states, produce in the child a typical vaccine vesicle. Several attempts have since been made to isolate the virus, but without definite success. Ernst and Martin, of Boston, have isolated from the bovine lymph a germ which grows on culture media and produces, when inoculated in the calf or in children, characteristic vesicles.

Phenomena of Vaccination.—In a primary vaccination, at the end of twenty-four or thirty-six hours there is seen at the point of insertion of the virus a slight papular elevation surrounded by a reddish zone. The papule gradually increases and on the fifth or sixth day shows a definite vesicle, the margins of which are raised while the centre is depressed. By the eighth day the vesicle has attained its maximum size. It is round and distended with a limpid fluid, the margin hard and prominent, and the umbilication is more distinct. By the tenth day the vesicle is still large and is surrounded by an extensive areola. The skin is also swollen, indurated, and often painful. On the eleventh or twelfth day the hyperæmia diminishes, the lymph becomes more opaque and begins to dry. By the end of the second week the vesicle is converted into a brownish scab which gradually becomes dry and hard, and in about a week (that is, about the twenty-first or twenty-fifth day from the vaccination) separates and leaves a circular pitted scar. If the points of inoculation have been close together, the vesicles fuse and may form a large combined vesicle. Constitutional symptoms of a more or less marked degree follow the vaccination. Usually on the third or fourth day the temperature rises, and may persist, increasing until the eighth or ninth day. In children it is common

Generalized Vaccinia It is not uncommon to see vesicles in the vicinity

+ Mynnie Ross about vaccinated died. Well.
about the 15th Jan a rash came out about the wrists + on the back. with the following characters

In a few instances tetanus has developed and proved fatal.—(Sons - Med. News. 1894.)

to have with the fever restlessness, particularly at night, and irritability; but as a rule these symptoms are trivial. If the inoculation is made on the arm, the axillary glands become large and sore; if on the leg, the inguinal glands. The above may be taken as representing the typical course of vaccination, whether performed with the humanised or with the animal lymph.

Successful vaccination is, for a time at least, an infallible protection against small-pox. The duration of the immunity is extremely variable, differing in different individuals. In some instances it is permanent, but a majority of persons within ten or twelve years again become susceptible.

Revaccination should be performed between the tenth and fifteenth year, and whenever small-pox is epidemic. The susceptibility to revaccination is curiously variable, and when small-pox is prevalent it is not well, if unsuccessful, to be content with a single attempt. The vesicle in revaccination is usually smaller, has less induration and hyperæmia, and the resulting scar is less perfect. Particular care should be taken to watch the vesicle of revaccination, as it not infrequently happens that a spurious pock is formed, which reaches its height early and dries to a scab by the eighth or ninth day. The constitutional symptoms in revaccination are sometimes quite severe.

An irregular course is uncommon in primary vaccination, but we occasionally meet with instances in which the vesicle develops rapidly with much itching, has not the characteristic flattened appearance, the lymph early becomes opaque, and the crust forms by the seventh or eighth day. In such cases the operation should again be performed with fresh lymph.

Complications.—In unhealthy subjects, or as a result of uncleanliness, or sometimes injury, the vesicles inflame and deep excavated ulcers result. Sloughing and deep cellulitis may follow. In debilitated children there may be with this a purpuric rash. Erysipelas may occur, or there may be deep gangrenous ulceration. Such instances are rare, but I have seen two which proved fatal. In one there was deep sloughing and in the other erysipelas. Cases of local dermatitis must not be mistaken for erysipelas. Among the most common complications are certain skin eruptions, some of which are due to the vaccine virus; others result from a mixed infection. Vaccine vesicles not infrequently break out in the immediate vicinity of the primary sores. Less commonly there is a general eruption of vesicles—generalized vaccinia—due to absorption of the virus. More frequent, perhaps, is the erythematous or roseolous rash. Contagious impetigo can also be inoculated with the virus, and may appear as a general eruption.

A question of special importance with reference to vaccination is the transmission of other diseases. For a time physicians were unwilling to acknowledge that constitutional disorders could be transmitted by vaccination, but it is now universally recognized that such transmission may take place, and this has emphasised the scrupulous care which should be taken in the performance of the operation.

Vaccino-Syphilis.—For a knowledge of this most serious of all accidents during vaccination we are largely indebted to Jonathan Hutchinson. It is a true instance of a mixed infection. The vaccine vesicles take as a rule their usual course, and it is not until they have healed or are in process of healing that the local changes characteristic of syphilis are manifested. The fact that syphilis may be transmitted in this way should put the practitioner on his guard in selecting humanised lymph. He should take it only from subjects with whose constitution he is perfectly familiar. Fortunately, the instances are extremely rare. They are, in fact, much less frequent than is usually supposed, and in a majority of the cases in which vaccino-syphilis is suspected the condition is really that of inflamed and indurated vaccinal ulcer. As the subject is of daily interest to the practitioner, and one which he may at any moment be called upon to decide, I here insert a table of differential features between vaccinal ulcers and vaccino-syphilis, and between the vaccination rashes and the secondary syphilitic eruptions, compiled by C. E. Shelly * from Fournier's lectures.

VACCINO-SYPHILIS.	VACCINATION ULCERS.
Chancre developed on the site of usually one or two only of the vaccination punctures.	Ulceration affects all the punctures as a rule.
Inflammation is slight.	Inflammation and ulceration severe.
Loss of substance superficial only.	Ulcer deeply excavated.
Suppuration scanty or absent, scabs or crusts formed.	Much suppuration.
Border of chancre smooth, slightly elevated, gradually merging into floor.	Margin of ulcer irregular, as in "soft chancre."
Surface of floor smooth.	Floor of ulcer uneven, suppurating.
Induration "parchment-like" and specific, not merely inflammatory.	Induration inflammatory only.
Inflammatory areola very slight.	Areola inflammatory and erysipelatous in character.
Gland swelling constant, indolent (syphilitic) bubo.	Gland swelling often absent; if present, merely inflammatory.
Complications rare.	Complications—sloughing, erysipelas, etc.—often present.
Chancre never developed before the fifteenth day after vaccination; usually not until after three to five weeks; still in its earlier stage twenty days after vaccination.	Ulceration is present twelve or fifteen days after vaccination and is fully developed by the twentieth day after vaccination.

* Fowler's Dictionary of Medicine. Article Vaccination.

SECONDARY SYPHILITIC ERUPTION due to true vaccino-syphilis.	VACCINATION RASHES (including roseola vaccinalis, miliaria vaccinalis, vaccinia bullosa, vaccinia hæmorrhagica); also accidental eruptions — rubeola, scarlatina, lichen, urticaria, etc.
Appears, at the earliest, nine or ten weeks after vaccination.	A true vaccinal rash appears between the ninth and fifteenth day after vaccination.
Requires, in every case, the pre-existence of a specific ulcer (chancre) at the site of vaccination.	Absence of inoculation chancre.
Exhibits the characters of a true specific eruption.	Eruption does not exhibit specific characters.
Fever often slight.	Fever always present.
Lasts for a long time.	Evanescent.
Usually accompanied by specific appearances on mucous membranes.	

VACCINO-SYPHILIS.	HEREDITARY SYPHILIS SHOWING ITSELF ABOUT THE TIME OF VACCINATION.
Begins with a local infection, chancre and indolent bubo.	No chancre; begins with general phenomena.
Typical development in four stages, viz., incubation, chancre, second incubation, generalization (secondary eruptions, etc.).	Has no typical development in connection with vaccination.
Never appears earlier than the ninth or tenth week after vaccination.	Time of development quite independent of vaccination.
	Is attended by the characteristic syphilitic bodily aspect.
	Other manifestations of hereditary syphilis may be present.
	The history may indicate syphilis.

Choice of Lymph.—Humanised lymph should be taken on the eighth day and only from perfectly formed unbroken vesicles, which have had a typical course, and have not yet developed areolæ. Pricking or scratching the surface, the greatest care being taken not to draw blood, allows the lymph to exude, and it may then be collected on ivory points or in capillary tubes. The child from which the lymph is taken should be healthy, strong, and known to be of good stock, free from tuberculous or syphilitic taint. Under these circumstances humanised lymph, one or

two removes from the calf, is usually very satisfactory in its action and is perfectly reliable.

In the case of the calf the most scrupulous care should be exercised in the vaccine farms to secure animals which are healthy and strong. The risk, however, that the calf has any disease which can be transmitted to man is exceedingly slight, as tuberculosis is very rare in cattle when young. Unquestionably, however, there may be risk in the case of a calf born of tuberculous parents, and special care should be taken in the selection of proper animals. There is no essential difference in the pocks which follow humanised lymph and bovine lymph. It was, I believe, a common experience in Montreal that children inoculated with bovine lymph had more constitutional disturbance and often sorer arms than those vaccinated with humanised lymph at one or two removes.

In the performance of the operation that part of the arm about the insertion of the deltoid is usually selected. Mothers "in society" prefer to have girl babies vaccinated on the leg. The skin should be cleansed and put upon the stretch. Then, with a lancet or the ivory point, cross-scratches should be made in one or more places. When the lymph has dried on the points it is best to moisten it in warm water. The clothing of the child should not be adjusted until the spot has dried, and it should be protected for a day or two with lint or a soft handkerchief. If erysipelas is prevalent, or if there are cases of suppuration in the same house, it is well to apply a pad of antiseptic cotton. Vaccination is usually performed at the second or third month. If unsuccessful, it should be repeated from time to time. A person exposed to the contagion of small-pox should always be revaccinated. This, if successful, will usually protect; but not always, as there are many instances in which, though the vaccination takes, variola also appears.

The Value of Vaccination.—Vaccination is not claimed to be an invariable and permanent preventive of small-pox, but in an immense majority of cases successful inoculation renders the person for many years insusceptible. Communities in which vaccination and revaccination are thoroughly and systematically carried out are those in which small-pox has the fewest victims. On the other hand communities in which vaccination and revaccination are persistently neglected are those in which epidemics are most prevalent. In the German army the practice of revaccination has stamped out the disease. Nothing in recent times has been more instructive in this connection than the fatal statistics of Montreal. The epidemic which started in 1870–'71 was severe in Lower Canada, and persisted in Montreal until 1875. A great deal of feeling had been aroused among the French Canadians by the occurrence of several serious cases of ulceration, possibly of syphilitic disease, following vaccination; and several agitators, among them a French physician of some standing, aroused a popular and wide-spread prejudice against the practice. There were indeed vaccination riots. The introduction of animal lymph was distinctly

beneficial in extending the practice among the lower classes, but compulsory vaccination could not be carried out. Between the years 1878 and 1884 a considerable unprotected population grew up and the materials were ripe for an extensive epidemic. The soil had been prepared with the greatest care and it only needed the introduction of the seed, which in due time came as already stated with the Pullman-car conductor from Chicago, on the 28th of February, 1885. Within the next ten months thousands of persons were stricken with the disease, and 3,164 died.

Although the effects of a single vaccination may wear out, as we say, and the individual again become susceptible to small-pox, yet the mortality in such cases is very much lower than in persons who have never been vaccinated. The mortality in persons who have been vaccinated is from 6 to 8 per cent, whereas in the unvaccinated it is at least 35 per cent. Marson pointed out some years ago that there is a definite ratio between the number of deaths and the number of good vaccination marks in post-vaccinal small-pox. With good marks the mortality is between 3 and 4 per cent, and with indifferent marks at least 10 to 15 per cent.

VI. VARICELLA (*Chicken-pox*).

Definition.—An acute contagious disease of children, characterised by an eruption of vesicles on the skin.

Etiology.—The disease occurs in epidemics, but sporadic cases are also met with. It may prevail at the same time as small-pox or may follow or precede epidemics of this disease. An attack of chicken-pox is no protection against small-pox. The disease [illegible] a majority of the cases occurring between the ages of two and seven years, but also attacks adults. The bacteriological examination of the vesicles has shown the presence of micrococci in the contents of the pustules, but the specific germ has not yet been discovered.

There can be no question that varicella is an entirely distinct disease from variola and without at present any relation whatever to it. An attack of the one does not confer immunity from an attack of the other. The case which Sharkey reported is of special importance in this connection. A boy, aged five, was admitted to St. Thomas' Hospital with a vesicular eruption, and was isolated in a ward on the same floor as the small-pox ward. The disease was pronounced chicken-pox, however, by Sir Risdon Bennett and Dr. Bristowe. The patient was then removed and vaccinated, with a result of four vesicles which ran a pretty normal course. On the eighth day from the vaccination the child became feverish. On the following day the papules appeared and the child had a well-developed attack of small-pox with secondary fever.

Symptoms.—After a period of incubation of ten or fifteen days the child becomes feverish and in some instances has a slight chill. There

See Stockstanks lecture. Lancet. 1894. vol. 2 p. 1. & Lancet Editorial Nov 27 th

In Montreal the statistics of 5000 cases in this point give, with good vaccines 8 per cent. + with poor vaccines 14; with spurious vaccinias 27; post vaccinal cases 16; unvaccinated cases 58.

beneficial in extending the practice among the lower classes, but compulsory vaccination could not be carried out. Between the years 1876 and 1884 a considerable unprotected population grew up and the materials were ripe for an extensive epidemic. The soil had been prepared with the greatest care and it only needed the introduction of the seed, which in due time came as already stated with the Pullman-car conductor from Chicago, on the 28th of February, 1885. Within the next ten months thousands of persons were stricken with the disease, and 3,164 died.

Although the effects of a single vaccination may wear out, as we say, and the individual again become susceptible to small-pox, yet the mortality in such cases is very much lower than in persons who have never been vaccinated. The mortality in persons who have been vaccinated is from 6 to 8 per cent, whereas in the unvaccinated it is at least 35 per cent. Marson pointed out some years ago that there is a definite ratio between the number of deaths and the number of good vaccination marks in post-vaccinal small-pox. With good marks the mortality is between 3 and 4 per cent, and with indifferent marks at least 10 or 11 per cent.

VI. VARICELLA (*Chicken-pox*).

Definition.—An acute contagious disease of children, characterised by an eruption of vesicles on the skin.

Etiology.—The disease occurs in epidemics, but sporadic cases are also met with. It may prevail at the same time as small-pox or may follow or precede epidemics of this disease. An attack of chicken-pox is no protection against small-pox. It is a disease of childhood; a majority of the cases occur between the second and sixth years. It is rarely seen in adults. The bacteriological examination of the vesicles has shown the presence of micrococci in the contents of the vesicles, but the specific germ has not yet been discovered.

There can be no question that varicella is an affection quite distinct from variola and without at present any relation whatever to it. An attack of the one does not confer immunity from an attack of the other. The case which Sharkey reported is of special importance in this connection. A boy, aged five, was admitted to St. Thomas' Hospital with a vesicular eruption, and was isolated in a ward on the same floor as the small-pox ward. The disease was pronounced chicken-pox, however, by Sir Risdon Bennett and Dr. Bristowe. The patient was then removed and vaccinated, with a result of four vesicles which ran a pretty normal course. On the eighth day from the vaccination the child became feverish. On the following day the papules appeared and the child had a well-developed attack of small-pox with secondary fever.

Symptoms.—After a period of incubation of ten or fifteen days the child becomes feverish and in some instances has a slight chill. There

may be vomiting and pains in the back and legs. Convulsions are rare. The eruption usually develops within twenty-four hours. It is first seen upon the trunk, either on the back or on the chest. ~~I have seen it, however, appear first~~ on the forehead and face. At first in the form of raised red papules, they are in a few hours transformed into hemispherical vesicles containing a clear or turbid fluid. There is no umbilication ~~as in the vesicles of small-pox.~~ They are often ovoid in shape and look more superficial than the variolous vesicles. The skin in the neighborhood is neither infiltrated nor hyperæmic. At the end of thirty-six or forty-eight hours the contents of the vesicles are purulent. They begin to shrivel and during the third and fourth days are converted into dark brownish crusts, which fall off and as a rule leave no scar. Fresh crops appear during the first two or three days of the illness, so that on the fourth day one can usually see pocks in all stages of development and decay. They are always discrete and the number may vary from eight or ten to several hundreds. As in variola, a scarlatinal rash occasionally precedes the development of the eruption.

There are one or two modifications of the rash which are interesting. The vesicles may become very large and develop into regular bullæ, looking not unlike ecthyma. The irritation of the rash may be excessive, and if the child scratches the pocks ulcerating sores may form, which on healing leave ugly scars. Indeed, cicatrices after chicken-pox are not so very uncommon. They are in my experience more common than after varioloid. The fever in varicella is slight, but it does not as a rule disappear with the appearance of the rash. The course of the disease is in a large majority of the cases favorable and no ill effects follow. The disease may recur in the same individual. There are instances in which a person has had three attacks.

~~There are one or two interesting complications of chicken-pox.~~ In delicate children, particularly the tuberculous, gangrene may occur about the vesicles (Abercrombie).

Cases have been described (Andrew) of hæmorrhagic varicella with cutaneous ecchymoses and bleeding from the mucous membranes.

Nephritis may occur. Infantile hemiplegia has developed during an attack of the disease.

The *diagnosis* is as a rule easy, particularly if the patient has been seen from the outset. When a case comes under observation for the first time with the rash well out, there may be considerable difficulty. The pocks in varicella are more superficial, more bleb-like, have not ~~the~~ so deeply an infiltrated areola about them, and may usually be seen in all stages of development. They rarely at the outset have the hard, shotty feeling of small-pox. The general symptoms, the greater intensity of the onset, the prolonged period of invasion, and the more frequent occurrence of prodromal rashes in small-pox are important points in the diagnosis.

No special *treatment* is required. If the rash is abundant on the

It may begin

but in rare instances the pox. are flattened & even a few may be umbilicated.

or pemphigus. (V. bullosa)

(Hutchinson) V. escharotica, or in other parts as scrotum

Death has followed in an uncomplicated case from extensive involvement of the skin (Nisbet. Aus. Med. Jr. 1894)

The abundance of the rash on the trunk (as varicella) is most important

face great care should be taken to prevent the child from scratching the pustules. A soothing lotion should be applied on lint.

VII. SCARLET FEVER.

Definition.—An infectious disease characterised by a diffuse exanthem and an angina of variable intensity.

Etiology.—We owe the recognition of scarlet fever as a distinct disease to Sydenham, before whose time it was confounded with measles. It is a wide-spread affection, occurring in nearly all parts of the globe and attacking all races.

The disease occurs sporadically from time to time, and then under unknown conditions becomes wide-spread. Epidemics vary in severity.

Among predisposing factors age is most important. A large proportion of the cases occur before the tenth year. Of an enormous number of fatal cases tabulated by Murchison over 90 per cent occurred in children under this age. Adults, however, are by no means exempt. Very young infants are rarely attacked. A certain number exposed to the contagion escape. In a family of children all more or less exposed one or two may not take the disease, whereas all as a rule, if exposed, take the measles. The susceptibility seems to vary in families, and we meet occasionally with sad instances in which three or more members of a family succumb in rapid succession.

Males and females are equally affected.

Epidemics prevail at all seasons, but perhaps with greater intensity in autumn and winter.

The contagion of scarlet fever is probably not developed until the eruption appears, and is particularly to be dreaded during desquamation. No doubt the poison is spread largely by the fine scaly particles which are diffused with the dust throughout the room. Even late in the disease, after desquamation has been apparently completed, a patient has conveyed the contagion. The poison clings with great persistence to clothing of all kinds and to articles of furniture in the room. In no disease is a greater tenacity displayed. Bedding and clothes which have been put away for months or even for years may, unless thoroughly disinfected, convey contagion. Physicians, nurses, and others in contact with the sick may carry the poison to persons at a distance. It is remarkable that in the case of physicians this does not more frequently occur. I know of but one instance in which I carried the contagion of this disease. The poison probably is not widely spread in the atmosphere. Observations have been recently made which indicate that the poison may be conveyed in milk. The epidemic investigated by Power and Klein in London in 1885 was traced by them to milk obtained from a dairy at Hendon, in which the cows were found to be suffering from a vesicular affection of

the udder. The nature of this disease of the cow is doubtful, however. Crookshank maintains that it was cow-pox, and had nothing to do with scarlet fever.

Some writers maintain that scarlet fever may be associated with defective house-drainage. Possibly the virus may occasionally gain entrance in this way.

The attack does not necessarily protect permanently. There are instances of a second and even a third attack.

Surgical and puerperal scarlatinas, so called, demand a word under this section. While scarlet fever may attack a person after operation, or a woman in childbed, the majority of the cases described as such represent, I believe, only the red rash of septicæmia. In the cases which I have seen the rash was rarely so widespread as in scarlet fever; the tongue had not the special features, nor was the throat affected. Desquamation is no criterion, as it occurs whenever hyperæmia of the skin persists for any length of time. It is interesting to note that these cases have become rare with the gradual disappearance of septicæmia. I. E. Atkinson suggests that these rashes are in many cases due to quinine.

Attempts to determine the specific germ of scarlet fever have so far proved ineffectual. Occasionally streptococci are found in the blood, and in fatal cases they are found in the lymph-glands and in the kidneys. It will no doubt soon be determined whether Loeffler's bacillus of diphtheria exists in the pseudo-membranes in the throat. Cornil and Babes state that it does, and that in the angina without diphtheria there are only streptococci. In some cases the bacillus of diphtheria has been found late in the disease. The point is one of great importance, and could be settled by careful observations.

Morbid Anatomy.—Except in the hæmorrhagic form, the skin after death shows no traces of the rash. There are no specific lesions. Those which occur in the internal organs are due partly to the fever and partly to infection with pus-organisms.

The anatomical changes in the throat are those of simple inflammation, follicular tonsillitis, and, in extreme grades, of pseudo-membranous angina. In severe cases there is intense lymphadenitis and much inflammatory œdema of the tissues of the neck, which may go on to suppuration, or even to gangrene. Streptococci are found abundantly in the glands and in the areas of suppuration. Of changes in the digestive organs, a catarrhal state of the gastro-intestinal mucosa is not uncommon. The liver may show interstitial changes (Klein). The spleen is often enlarged.

Endocarditis and pericarditis are not infrequent. Myocardial changes are less common. The renal changes are the most important, and have been thoroughly studied by Coats, Klebs, Wagner, and others. The special nephritis of the disease will be considered with the diseases of the kidney.

Affections of the respiratory organs are not frequent. When death

Look up - L.G. Reports.

The specific germ of the disease is still unknown. Streptococci are found in the skin in the blood, sometimes, and in the organs of fatal cases. It has even been urged that the disease is only a form of streptococcus infection. Throat lesions of the most malignant-type may occur without the presence of the Loeffler-bacillus. The streptococcus pyogenes is the common organism of the otitis media (R.B. Dench) and

"from one to seven days; of most two to four" (Clin Soc Lon)

at first

red.

In a few days the 'fur' desquamates and the tongue leaves the surface red & rough. This condition which some writers call the 'strawberry' or better 'the' 'raspberry' tongue

results from the pseudo-membranous angina, broncho-pneumonia is not uncommon. Cerebro-spinal changes are rare.

Symptoms.—Incubation.—On this point there is great discrepancy. The period is undoubtedly very variable. From three to twelve days is probably the limit, though it may in exceptional cases be extended. In one case, the circumstances of which made it perfectly clear that I had myself conveyed the infection, the incubation was twelve days.

Invasion.—The onset is as a rule sudden. It may be preceded by a slight scarcely noticeable indisposition. An actual chill is rare. Vomiting and, in young children, convulsions are common. The fever is intense; rising rapidly, it may on the first day reach 104° or even 105°. The skin is unusually dry and to the touch gives a sensation of very pungent heat. The tongue is furred, and as early as the first day there may be complaint of dryness of the throat. Cough and catarrhal symptoms are uncommon. The face is often flushed and the patient has all the objective features of an acute fever.

Eruption.—Usually on the second day, in some instances within twenty-four hours, the rash develops in the form of scattered red points on a deep subcuticular flush. It appears first on the neck and chest, and spreads so rapidly that by the evening of the second day it may have invaded the entire skin. In pronounced cases the rash at its height has a vivid scarlet hue, quite distinctive and unlike that seen in any other eruptive disease. It is entirely hyperæmic, and the anæmia produced by pressure instantly disappears. In some cases the rash does not become uniform but remains patchy, and intervals of normal skin separate large hyperæmic areas. Tiny papular elevations may sometimes be seen, but they are not so common as in measles. At the height of the eruption sudaminal vesicles may develop, the fluid of which may become turbid. The entire skin may at the same time be covered with small yellow vesicles on a deep red background. Pronounced cases of this type were called by the older writers *scarlatina miliaris.*

Occasionally there are petechiæ, which in the malignant type of the disease become wide-spread and large. The eruption does not always appear upon the face. There may be a good deal of swelling of the skin which feels uncomfortable and tense. The itching is variable; not as a rule intense at the height of the eruption. After persisting for two or three days the rash gradually fades. The rash can often be seen on the mucous membranes of the palate, the cheeks and the tonsils, giving to these parts a vivid red, punctiform appearance. The tongue is red at the tip and edges, furred in the centre; and through the white fur are often seen the swollen papillæ, which give the so-called "strawberry" appearance to the tongue. The breath often has a very heavy, sweet odor.

The pharyngeal symptoms vary extremely. There may be—

1. Slight redness, with swelling of the pillars of the fauces and of the tonsils.

2. A more intense grade of swelling and infiltration of these parts with a follicular tonsillitis.

3. Membranous angina with intense inflammation of all the pharyngeal structures and swelling of the glands below the jaw, and in very severe cases a thick brawny induration of all the tissues of the neck.

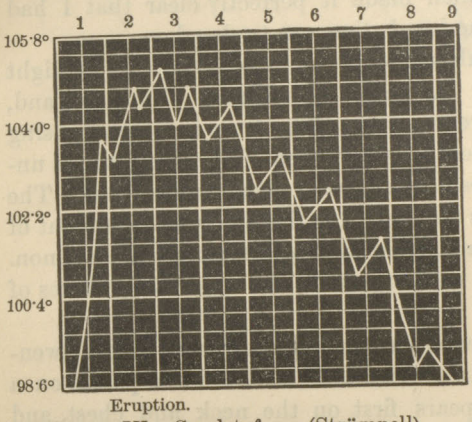


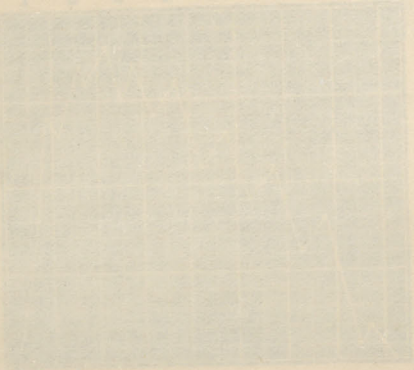
CHART IX.—Scarlet fever (Strümpell).

The fever, which sets in with such suddenness and intensity, may reach 105° or even 106°. It persists with slight morning remissions, gradually declining with the disappearance of the rash. In mild cases the temperature may not reach 103°; on the other hand, in very severe cases there may be hyperpyrexia, the thermometer registering 108° or even before death 109°.

The pulse presents the ordinary febrile characters, ranging in children from 120° to 150°, or even higher. The respirations show an increase proportionate to the intensity of the fever. The gastro-intestinal symptoms are not marked after the initial vomiting, and food is usually well taken. In some instances there are abdominal pains. The edge of the spleen may be palpable. The liver is not often enlarged. With the initial fever nervous symptoms are present in a majority of the cases; but as the rash comes out the headache and the slight nocturnal wandering disappear. The urine has the ordinary febrile characters, being scanty and high colored. Albuminuria is by no means infrequent during the stage of eruption, but the amount is slight. Careful examination of the urine should be made every day. There is no cause for alarm in the slight trace of albumen which is so often present, not even if it is associated with a few tube-casts.

Desquamation.—With the disappearance of the rash and the fever the skin looks somewhat stained, is dry, a little rough, and gradually the upper layer of the cuticle begins to separate. The process usually begins about the neck and chest, and flakes are gradually detached. The degree and character of the desquamation bear some relation to the intensity of the eruption. When the latter has been very vivid and of long-standing, large flakes may be detached. In rare instances the hair and even the nails have been shed. It must not be forgotten that there are cases in which the desquamation has been prolonged, according to Trousseau, even to the seventh or eighth week. The entire process lasts from ten to fifteen or even twenty days.

There are cases of exceptional mildness in which the rash may be



are / 8

X

scarcely perceptible. During epidemics, when several children of a household are affected, it sometimes happens that a child sickens as if of scarlet fever, and has a sore throat and the "strawberry tongue" without the development of any rash. This is the so-called *scarlatina sine eruptione.*

These slight cases of scarlet fever may be followed by the severest attacks of nephritis.

MALIGNANT SCARLET FEVER.

Ataxic Form.—This presents all the characteristics of an acute intoxication. The patient overwhelmed by the intensity of the poison may die within twenty-four or thirty-six hours. The disease sets in with great severity—high fever, extreme restlessness, headache, and delirium. The temperature may rise to 107° or even 108°, and rare cases have been observed in which the thermometer has registered even higher. Convulsions may occur in children. The initial delirium rapidly gives place to coma. The dyspnœa may be urgent; the pulse is very rapid and feeble.

Hæmorrhagic Form.—In some instances hæmorrhages occur into the skin. There is hæmaturia, and epistaxis. In the erythematous rash there are at first scattered petechiæ, which gradually become more extensive, and ultimately the skin may be universally involved. Death may take place on the second or on the third day. While this form is perhaps more common in enfeebled children, I have twice known it to attack persons apparently in full health.

Anginose Form.—The throat symptoms may appear early and progress rapidly. The fauces and tonsils are swollen. Membranous exudation forms. It may extend to the posterior wall of the pharynx, forward into the mouth, and upward into the nostrils. The glands of the neck rapidly enlarge. Necrosis occurs in the tissues of the throat, the fœtor is extreme, the constitutional disturbance profound, and the child dies with the clinical picture of a malignant diphtheria. Occasionally the membrane extends into the trachea and the bronchi. The Eustachian tubes and the middle ear are usually involved. In cases in which death does not take place rapidly from toxæmia there may be extensive abscess formation in the tissues of the neck and sloughing. In the separation of deep sloughs about the tonsils the carotid artery may be opened, causing fatal hæmorrhage.

As already mentioned, scarlatinal angina, though resembling diphtheria and not to be distinguished from it anatomically, is probably due to the scarlatinal and not to the diphtheritic poison.

Complications and Sequelæ.—(*a*) *Nephritis.*—At the height of the fever there is often a slight trace of albumen in the urine, which is not of special significance. In a majority of cases the kidneys escape without greater damage than occurs in other acute febrile affections.

Nephritis is most common in the second or third week and may develop after a very mild attack. It may be delayed until the third or

fourth week. As a rule, the earlier it develops in the disease the more intense it is. It varies greatly in intensity, and three grades of cases may be recognized:

1. Very severe cases with suppression of urine or the passage of a small quantity of dark bloody urine laden with albumen and tube-casts. Vomiting is constant, there are convulsions, and the child dies with the symptoms of acute uræmia.

2. Less severe cases without any serious acute symptoms. There is a puffy appearance of the eyelids, with slight œdema of the feet; the urine is diminished in quantity, smoky in appearance, and contains albumen and tube-casts. The kidney symptoms then dominate the entire case, the dropsy persists, and there may be effusion into the serous sacs. The case may drag on and become chronic, or the patient may succumb to uræmic accidents. Fortunately, in a majority of the cases the disease yields to judicious treatment and recovery takes place.

3. Cases so mild that they can scarcely be termed nephritis. The urine shows a moderate amount of albumen. There may be tube-casts, rarely blood. The œdema is extremely slight or transient, and the convalescence is scarcely interrupted. Occasionally, however, in these mild attacks serious symptoms may supervene. Œdema of the glottis may prove rapidly fatal, and in one case of the kind a child under my care died of acute effusion into the pleural sacs.

There are instances of œdema without albuminuria or signs of nephritis. Possibly in some of these cases the œdema may be hæmic and due to the anæmia; but there are instances in which marked changes have been found in the kidney after death, even when the urine did not show the features characteristic of nephritis.

(*b*) *Arthritis.*—During the subsidence of the fever, rarely at its height, pains and swelling in the joints may develop and present all the characteristics of acute rheumatism. In all probability it is not however true rheumatism, but is analogous to gonorrhœal synovitis. It may pass on to suppuration, in which case it most commonly involves only a single joint.

(*c*) *Cardiac Complications.*—Simple endocarditis is not uncommon, and many cases of chronic valvular disease originate probably in the latent endocarditis of this disease. Malignant endocarditis is rare. Pericarditis is probably not more frequent, but is less likely to be overlooked than endocarditis. It usually develops during convalescence, and may be sero-fibrinous or purulent. The cardiac complications are sometimes found in association with arthritis. Myocarditis is not uncommon.

(*d*) *Pleurisy* may follow *pneumonia*, though this is rare. More often it occurs during convalescence, is insidious in its course, and as a rule purulent. This serious complication of scarlet fever is not sufficiently recognized. It was one upon which my teacher, R. P. Howard,* in Mont-

* Canada Medical and Surgical Journal, December, 1872.

Adema of the eyelids, without nephritis (S. Philips)

real, specially insisted in his lectures. Sheriff, in a number of the same journal, reports two cases, occurring at the same time in brothers, one of whom died suddenly after a slight exertion.

(*e*) *Ear Complications.*—These are common and serious. They are due to extension of the inflammation from the throat through the Eustachian tubes. It is one of the most frequent causes of deafness. The severe forms of membranous angina are almost always associated with inflammation of the middle ear, which goes on to suppuration and perforation of the drum. The suppuration may extend to the labyrinth and rapidly produce deafness. In other instances there is suppuration in the mastoid cells. In the necrosis which follows the middle-ear disease, the facial nerve may be involved and paralysis follow. Later, still more serious complications may follow the otitis; such as thrombosis of the lateral sinus, meningitis, or abscess of the brain.

(*f*) *Adenitis.*—In comparatively mild cases of scarlet fever the submaxillary lymph-glands may be swollen. In severer cases the swelling of the neck becomes extreme and extends beyond the limits of the glands. Acute phlegmonous inflammations may occur, leading to wide-spread destruction of tissue, in which vessels may be eroded and fatal hæmorrhage ensue. The suppurative processes may also involve the retro-pharyngeal tissues.

The swelling of the lymph-glands usually subsides, and within a few weeks even the most extensive enlargement gradually disappears. There are rare instances, however, in which the lymphadenitis becomes chronic and the neck remains with a glandular collar which almost obliterates its outline. This may prove intractable to all ordinary measures of treatment. A case came under my observation in which, two years after scarlet fever, the neck was enormously enlarged and surrounded by a mass of firm brawny glands.

(*g*) *Nervous Complications.*—Chorea occasionally develops in connection with the arthritis and endocarditis. Sudden convulsions followed by hemiplegia may occur. Two instances of progressive paralysis of the limbs with wasting came under my observation at the Philadelphia Infirmary for Nervous Diseases. The history was that of subacute ascending spinal paralysis, but it is probable that they were instances of multiple neuritis. Mental symptoms, mania and melancholia, have been described.

(*h*) Other rare complications and sequelæ are ~~eye-affections~~, symmetrical gangrene, enteritis, and noma.

Diagnosis.—The diagnosis of scarlet fever is not difficult, but there are cases in which the true nature of the disease is for a time doubtful. The following are the most common conditions with which it may be confounded.

1. *Acute Exfoliating Dermatitis.*—This pseudo-exanthem simulates scarlet fever very closely. It has a sudden onset, with fever. The eruption spreads rapidly, is uniform, and after persisting for five or six days

begins to fade. Even before it has entirely gone, desquamation usually begins. Some of these cases cannot be distinguished from scarlet fever in the stage of eruption. The throat symptoms, however, are usually absent, and the tongue rarely shows the changes which are so marked in scarlet fever. In the desquamation of this affection the hair and nails are commonly affected. It is, too, a disease liable to recur. Some of the instances of second and third attacks of scarlet fever have been cases of this form of dermatitis.

2. *Measles*, which is distinguished by the longer period of invasion, the characteristic nature of the prodromes, and the later appearance of the rash. The greater intensity of the measly rash upon the face, the more papular character, the irregular crescentic distribution, are distinguishing features in a majority of the cases. Other points are the absence of the sore throat in measles and the peculiar character of the desquamation.

3. *Rötheln.*—The rash of rubella is sometimes strikingly like that of scarlet fever, but in the great majority of cases the mistake could not arise. In cases of doubt the general symptoms are our best guide.

4. *Septicæmia.*—As already mentioned, the so-called puerperal or surgical scarlatina shows an eruption which may be identical in appearance with that of true scarlet fever.

5. *Diphtheria.*—The practitioner may be in doubt whether he is dealing with a case of scarlet fever with intense membranous angina, or a true diphtheria with an erythematous rash. The erythema in diphtheria may appear early, before the throat symptoms are well developed, or as they are appearing, in which case it is usually slight and disappears quickly. There is also, when the disease is at its height, a later erythema, which may be very diffuse and intense. The subsequent desquamation can not always be relied upon to make clear the diagnosis, for any intense erythema of sufficient duration will be followed by this process. None of the preceding conditions offer difficulties so great as these cases of angina with erythematous rash, and it may be impossible to determine satisfactorily the true nature of the trouble. Fortunately, so far as treatment is concerned, this does not make much difference. A bacteriological examination of the exudate should be made in doubtful cases.

6. *Drug Rashes.*—These are partial, and seldom more than a transient hyperæmia of the skin. Occasionally they are diffuse and intense, and in such cases very deceptive. They are not associated, however, with the characteristic symptoms of invasion. There is no fever, and with care the distinction can usually be made. They are most apt to follow the use of belladonna, quinine, and iodide of potassium.

Prognosis.—Epidemics differ in severity and the death-rate is extremely variable. Among the better classes the death-rate is much less than in hospital practice. There are physicians who have treated consecutively a hundred or more cases without a death. On the other hand, in hospitals and among the poorer classes the death-rate is considerable,

Or Carbolated vaseline or a 5 per cent
hydro-naphthol soap.
(Med News 4.22.93/4.435

ranging from 5 to 10 per cent in mild epidemics to 20 or 30 per cent in the very severe.

The younger the child the greater the danger. In infants under one year the death-rate is very high. The great proportion of fatal cases occurs in children under six years of age.

The unfavorable symptoms are very high fever, early mental disturbance with great jactitation, the occurrence of hæmorrhages (cutaneous or visceral), intense pseudo-membranous angina with cervical bubo, and signs of laryngeal obstruction.

Nephritis is always a serious complication and when setting in with suppression of the urine may quickly prove fatal. It is noteworthy, however, that a large majority of the cases of scarlatinal nephritis recover.

Treatment.—The disease cannot be cut short. In the presence of the severer forms we are still too often helpless. There is no disease in which the successful issue and the avoidance of complications depends more upon the skilled judgment of the physician and the care with which his instructions are carried out.

The child should be isolated and placed in charge of a competent nurse. The temperature of the room should be constant and the ventilation thorough. The child should wear a light flannel night-gown, and the bedclothing should not be too heavy. The diet should consist of milk, broths, and fresh fruits, and water should be freely given. With the fall of the temperature, the diet may be increased and the child may gradually return to ordinary fare. When desquamation begins the child should be thoroughly rubbed every day, or every second day, with sweet oil, which prevents the drying and the diffusion of the scales. An occasional warm bath may then be given. At any time during the attack the skin may be sponged with warm water. The patient may be allowed to get up after the temperature has been normal for ten days, but for at least three weeks from this time great care should be exercised to prevent exposure to cold. It must not be forgotten, also, that the renal complications are very apt to develop during the convalescence, and after all danger is apparently past. Ordinary cases do not require any medicine, or at the most a simple fever mixture, and during convalescence a bitter tonic. The bowels should be carefully regulated, ~~either with small doses of calomel or with mild aperients~~.

Special symptoms in the severe cases call for treatment.

When the temperature is above 103° the extremities may be sponged with tepid water. In severe cases, with the temperature rapidly rising, this will not suffice, and more thorough measures of hydrotherapy should be practised. With pronounced delirium and nervous symptoms the cold-pack should be used. When the temperature is rising rapidly but the child is not delirious, he should be placed in a warm bath, the temperature of which can be gradually lowered. The bath at a temperature of 80° is beneficial. In giving the cold-pack a rubber sheet and a thick layer of

blanket should be laid upon a sofa or a bed, and upon this a sheet, wrung out of cold water. The naked child is then laid upon it and wrapped in the blankets. An intense glow of heat quickly follows the preliminary chilling, and from time to time the blankets may be unfolded and the child sprinkled with cold water. The good effects which follow this plan of treatment are often striking, particularly in allaying the delirium and jactitation, and procuring quiet and refreshing sleep. Parents will object less, as a rule, to the warm bath gradually cooled than to any other form of hydrotherapy. The child may be removed from the warm bath, placed upon a sheet wrung out of tolerably cold water, and then folded in blankets. The ice-cap is very useful and may be kept constantly applied in cases in which there is high fever. Medicinal antipyretics are not of much service in comparison with cold water.

The throat symptoms, if mild, do not require much treatment. Applications may be made with a spray, and if the laryngitis becomes severe the measures should be used which will be mentioned under croup. Cold applications to the neck are to be preferred to hot, though it is sometimes difficult to get a child to submit to them. In connection with the throat symptoms the ears should be specially looked after, and a careful disinfection of the throat by suitable antiseptic solutions should be practised. When the inflammation extends through the tubes to the middle ear, the practitioner should either himself daily examine the conditions of the drum, or, when available, a specialist should be called in to assist him in the case. The careful watching of this membrane day by day and the puncturing of it if the tension becomes too great may save the hearing of the child. With the aid of cocaine the drum is readily punctured. The operation may be repeated at intervals if the pain and distention return. No complication of the disease is more serious than this extension of the inflammatory process to the ear.

The nephritis should be dealt with as in ordinary cases, and indications for treatment will be found under the appropriate section. It is worth mentioning, however, that Jaccoud insists upon the great value of milk diet in scarlet fever as a preventive of nephritis.

Among other indications for treatment in the disease is cardiac weakness, which is usually the result of the direct action of the poison, and is best met by stimulants.

Many specifics have been vaunted in scarlet fever, but they are all useless. J. C. Wilson recommends chloral in one or two grain doses for a child of two or three years.

VIII. MEASLES.

If severe the local measures should be used mentioned under Diphtheria.

"From seven to eighteen days." Attended fourteen ~~days~~ months" (Am Soc Co)

VIII. MEASLES.

Definition.—An acute, highly infectious disorder, characterised by an initial coryza and a rapidly spreading eruption.

Etiology.—The infection of measles is very intense and immunity against attack not nearly so common as in scarlet fever. It is a disease of childhood, but unprotected adults are liable to the infection. Indeed, measles is more frequent in adults than is scarlet fever. Within the first six months of life the liability is not so marked, though I have known infants of a month and of six weeks to be attacked. The sexes are equally affected. The contagion is communicated by the breath and by the secretions, particularly those of the nose. It may be conveyed by a third person and by fomites.

The disease is practically endemic in large centres of population, and from time to time spreads and prevails epidemically. It occurs at all seasons, but prevails more extensively during the colder months. There is no infectious disease in which recurrence is more frequent. There may be a second, third, or even a fourth attack.

The contagion of the disease is unknown. No one of the various organisms which have been described meets the requirements of Koch's law.

Morbid Anatomy.—Measles itself rarely kills, but the complications and sequelæ combine to make it a very fatal affection in children. There are no characteristic post-mortem appearances. The skin changes are those associated with an intense hyperæmia.

There is a catarrhal condition of the mucous membranes, particularly of the bronchi. The fatal cases show almost invariably either broncho-pneumonia, capillary bronchitis with patches of collapse, or less frequently lobar pneumonia. The bronchial glands are invariably swollen. Pleurisy is less common. During convalescence from measles there is a special liability to tuberculous invasion, and tuberculous broncho-pneumonia claims a large number of victims. The bronchial glands may also be affected.

The gastro-intestinal mucosa may be hyperæmic. Swelling of Peyer's glands is not at all uncommon and may reach a very intense grade in the patches.

Symptoms.—**Incubation.**—~~This is about ten days, but the limits are variable, and it may be as long as twenty days.~~ The disease has been frequently inoculated. In such cases the incubation period is less than ten days.

Invasion.—The disease usually begins with symptoms of a feverish cold. There are shiverings (not often a definite chill), marked coryza, sneezing, running at the nose, redness of the eyes and lids, with photophobia, and within twenty-four hours cough. These early catarrhal symptoms are more marked in measles than in any other infectious disease of children. There may be the symptoms so commonly associated with an on-coming fever—nausea, vomiting, and headache. The tongue is

furred. Examination of the throat may show a reddish hyperæmia or in some instances a distinct punctiform rash. Occasionally this spreads over the whole mucous membrane of the mouth with the exception of the tongue. The temperature at this stage is usually high, reaching from 103° to 104°, ascending gradually through the second and third days.

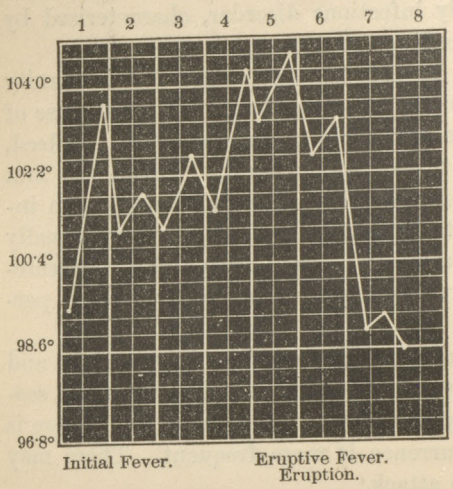


CHART X.—Measles (Strümpell).

Eruption. — Usually on the fourth day, when the fever and general symptoms have reached their height, the rash appears upon the cheeks or forehead in the form of small red papules, which increase in size and spread over the neck and thorax. When the eruption becomes well developed the face is swollen and covered with reddish blotches, which often have rounded or crescentic outlines. Here and there is an intervening portion of unaffected skin. At this stage the cervical lymph-glands may be slightly swollen and sore. The papules can now be felt with the finger. Sometimes they are quite shotty, but do not extend deep into the skin. On the trunk and extremities the swelling of the skin is not so noticeable, the color of the rash not so intense and often less uniform. The mottled, blotchy character of the rash appears most clearly on the chest or the abdomen. The rash is hyperæmic and disappears on pressure, but in the more malignant cases it may become petechial. The general symptoms do not abate with the occurrence of the eruption. They persist until the end of the fifth or the sixth day, when in the majority of the cases all the symptoms become mitigated. Among the peculiarities of the rash may be mentioned the development of numerous miliary vesicles and the occurrence of petechiæ, which are seen occasionally even in cases of moderate severity.

Desquamation.—After persisting for two or three days the rash gradually fades and desquamation occurs in the form of very fine branny scales, which may be difficult to see and are wholly unlike the coarse exfoliation in scarlet fever.

The catarrhal symptoms gradually disappear and convalescence is rapidly established.

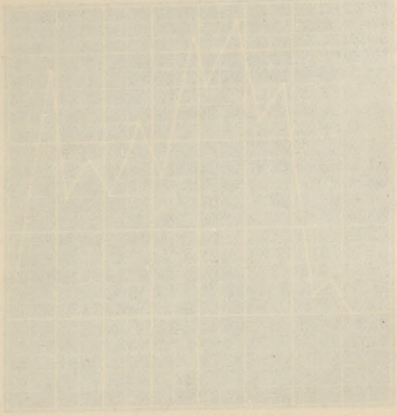
In epidemics of measles atypical cases are common. The rash may appear early, within thirty-six hours of the onset of the symptoms; or, on the other hand, it may be delayed until the sixth day. As in other exanthems, when many cases occur in a household, one of the children may

Measles -

Sometimes also the glands in the groins, axilla, and at the elbow. [Mallock's case] ×

Leucorrhœa

jaun



have all the initial symptoms and "sicken for the disease," as it is said, but no eruption appear.

The most serious variety of measles is that in which hæmorrhages occur—the *morbilli hæmorrhagici*. In general practice these cases are very uncommon. Occasionally in institutions, particularly when the hygienic surroundings are bad, one or two cases develop during an epidemic. It has been frequently seen in camps and when the disease is freshly imported into a native population, as in the Fiji Islands. During the civil war, as shown by Smart's statistics, some cases occurred.

In this form the disease sets in with much greater intensity, the rash becomes petechial, hæmorrhages occur from the mucous membranes, the constitutional depression is very great, and death occurs early from toxæmia.

Complications and Sequelæ.—These are met with chiefly in the respiratory system. The danger comes from the existing bronchitis, which is apt to extend into the smaller tubes and lead to collapse and broncho-pneumonia. When limited in extent this causes only aggravation of the cough and persistence of the fever (symptoms which gradually abate), and convalescence is rapid; but in debilitated children, more particularly in institutions and among the lower classes, this complication is extremely grave and is responsible for the high death-rate from measles in the community. In some instances the clinical picture is that of a suffocative catarrh, the result of a wide-spread involvement of the smaller tubes. The description of the condition will be found under the section Broncho-pneumonia. Lobar pneumonia is less common and perhaps less dangerous.

Laryngitis is not uncommon: the voice becomes husky and the cough croupy in character. Œdema of the glottis is very rare. Pseudo-membranous inflammation of the pharynx and larynx may occur and prove fatal. In debilitated infants severe stomatitis, ~~or even~~ *cancrum oris* may develop.

Catarrhal inflammation of the middle ear is not very uncommon, and may proceed to suppuration and to perforation of the drum. The conjunctival catarrh rarely leads to further trouble, though occasionally the inflammation becomes purulent.

Intestinal catarrh is common in some epidemics, and there may be the symptoms of acute colitis.

Nephritis is an exceedingly rare complication.

Of the sequelæ of measles, tuberculosis is the most important—either an involvement of the bronchial glands, a miliary tuberculosis, or a tuberculous broncho-pneumonia.

Among the rarer sequelæ of measles are paralyses. Hemiplegia is very rare, but cases of paraplegia have been described. Thomas Barlow *

* Medico-Chirurgical Society's Transactions, 1887.

reports a fatal case in which the symptoms occurred early, the paralysis extended rapidly and involved the upper limbs, and death took place on the eleventh day. Marked vascular changes were found in the gray matter of the spinal cord, and were believed to depend on an early disseminated myelitis. Examination of the peripheral nerves was not made. Similar cases are met with in the literature, and they probably come under the division of the post-febrile polyneuritis, though of course it is not impossible that some of them, such as Barlow's case, may be due to a rapidly ascending myelitis.

Diagnosis.—From scarlet fever, with which it is most likely to be confounded, measles is distinguished by the longer initial stage with characteristic symptoms, and the blotchy irregular character of the rash, which is so unlike the diffuse uniform erythema of scarlet fever. Occasionally in measles, when the throat is very sore and the eruption pretty diffuse, there may at first be difficulty in determining which disease is present, but a few days should suffice to make the diagnosis clear. It may be extremely difficult to distinguish from rötheln. I have more than once known practitioners of large experience unable to agree upon a diagnosis. The shorter prodromal stage, the slighter fever in many cases, are perhaps the most important features. It is difficult to speak definitely about the distinctions in the rash, though perhaps the more uniform distribution and the absence of the crescentic arrangement are more constant in rötheln.

The conditions under which measles may be mistaken for small-pox have already been described. Of drug eruptions, that induced by copaiba is very like measles, but is readily distinguished by the absence of fever and catarrh.

Prognosis.—The mortality bills of large cities show what a serious disease measles is in a community. Among the eruptive fevers it ranks third in the death-rate. The mortality from the disease itself is not high, but the pulmonary complications render it one of the most serious of the diseases of children.

In some epidemics the disease is of great severity. In institutions and in armies the death-rate is often high. The fever itself is rarely a source of danger. The extension of the catarrhal symptoms to the finer tubes is the most serious indication.

Treatment.—Confinement to bed in a well-ventilated room and a milk diet are the only measures necessary in cases of uncomplicated measles. The fever rarely reaches a dangerous height. If it does it may be lowered by sponging or by the tepid bath gradually reduced. If the rash does not come out well, warm drinks and a hot bath will hasten its maturation. The bowels should be freely opened. If the cough is distressing, paregoric and a mixture of ipecacuanha wine and squills should be given. The patient should be kept in bed for a few days after the fever subsides. During desquamation the skin should be oiled daily,

< Dukes urges the adoption of the name epidemic roseola as the technical — and rose-rash as the common name for the disease (See his pamphlet on Epidem. ic Roseola — Lond., Churchill & Co. 1894).

and warm baths given to facilitate the process. The convalescence from measles is the most important stage of the disease. Watchfulness and care may prevent serious pulmonary complications. The frequency with which the mothers of children with simple or tuberculous bronchopneumonia tell us that "the child caught cold after measles," and the contemplation of the mortality bills should make us extremely careful in our management of this affection.

IX. RUBELLA (*Rötheln, German Measles*).

This exanthem has also the names of *rubeola notha*, or epidemic roseola, and, as it is supposed to present features common to both, has been also known as hybrid measles or hybrid scarlet fever. It is now generally regarded, however, as a separate and distinct affection.

Etiology.—It is propagated by contagion and spreads with great rapidity. It frequently attacks adults, and the occurrence of either measles or scarlet fever in childhood is no protection against it. The epidemics of it are often very extensive.

Symptoms.—These are usually mild, and it is altogether a less serious affection than measles. Very exceptionally, as in the epidemics studied by Cheadle, the symptoms are severe.

The stage of incubation ranges from ten to twelve days.

In the stage of invasion there are chilliness, headache, pains in the back and legs, and coryza. There may be very slight fever. In 30 per cent of Edwards's cases the temperature did not rise above 100°. The duration of this stage is somewhat variable. The rash usually appears on the first day, some writers say on the second, and others again give the duration of the stage of invasion as three days. Griffith places it at two days. The eruption comes out first on the face, then on the chest, and gradually extends so that within twenty-four hours it is scattered over the whole body. It may be the first symptom noted by the mother. The eruption consists of a number of round or oval, slightly raised spots, pinkish-red in color, usually discrete, but sometimes confluent.

The color of the rash is somewhat brighter than in measles. The patches are less distinctly crescentic. After persisting for two or three days (sometimes longer), it gradually fades and there is a slight furfuraceous desquamation. The rash persists as a rule longer than in scarlet fever or measles, and the skin is slightly stained after it. The lymphatic glands of the neck are frequently swollen, and, when the eruption is very intense and diffuse, the lymph-glands in the other parts of the body.

There are no special complications. The disease usually progresses favorably; but in rare instances, as in those reported by Cheadle, the symptoms are of greater severity. Albuminuria may occur and even

nephritis. Pneumonia and colitis have been present in some epidemics. Icterus has been seen.

Diagnosis.—The mildness of the case, the slightness of the prodromal symptoms, the mildness or the absence of the fever, the more diffuse character of the rash, its rose-red color, and the early enlargement of the cervical glands, are the chief points of distinction between rötheln and measles.

The treatment is that of a simple febrile affection. It is well to keep the child in bed, though this may be difficult, as the patient rarely feels ill.

X. EPIDEMIC PAROTITIS (*Mumps*).

Definition.—An infectious disease, characterised by inflammation of the parotid gland. The testes in males and the ovaries and breasts in females are sometimes involved.

Etiology.—The nature of the virus is unknown. It is probably a micro-organism, and a *bacillus parotidis* has been described.

The affection has all the characters of an epidemic disease. It is said to be endemic in certain localities, and probably is so in large centres of population. At certain seasons, particularly in the spring and autumn months, the number of cases increases rapidly. It is met most frequently in childhood and adolescence. Very young infants and adults are seldom attacked. Males are somewhat more frequently affected than females. In institutions and schools the disease has been known to attack over 90 per cent of all the children. It may be curiously localised in a city or district. The disease is contagious and spreads from patient to patient.

A remarkable idiopathic, non-specific parotitis may follow injury or disease of the abdominal or pelvic organs. Stephen Paget* has collected 101 cases of this kind, the majority of which were not associated with septic processes. (see diseases of the Salivary Glands)

Symptoms.—The period of incubation is from two to three weeks, and there are rarely any symptoms during this stage. The invasion is marked by fever, which is usually slight, rarely rising above 101°, but in exceptionally severe cases going up to 103° or 104°. The child complains of pain just below the ear on one side. Here a slight swelling is noticed, which increases gradually, until, within forty-eight hours, there is great enlargement of the neck and side of the cheek. The swelling passes forward in front of the ear, and back beneath the sterno-cleido muscle. The other side usually becomes affected within a day or two. The submaxillary glands may also be involved. The greatest inconvenience is experienced in taking food, for the patient is unable to open the mouth, and

* British Medical Journal, March 19, 1887.

One or both testicles may be involved.

1 The orchitis may develop before the parotitis, or in rare instances
2 may be the only manifestation of the infection (orchitis parotidea)

Cases of atrophy 1 Gee
2 Gee
3 Case ruled by Power Published Jr 1889 [illegible]

Unilaterally or rarely one organ, but it has occurred in both & if before puberty
3 with production of feminism The proportion of cases of orchitis
varies in different Epidemics. 211 cases occurred in 699 cases and
103 cases of atrophy followed 163 instances of orchitis (Comby)

The lachrymal glands may be involved

even speech and deglutition become difficult. There may be an increase in the secretion of the saliva, but the reverse is sometimes the case. There is seldom great pain, but, instead, an unpleasant feeling of tension and tightness. There may be earache and slight impairment of hearing.

After persisting for from seven to ten days, the swelling gradually subsides and the child rapidly regains his strength and health. Relapse rarely if ever occurs.

Occasionally the disease is very severe and characterised by high fever, delirium, and great prostration. The patient may even lapse into a typhoid condition.

One of the most remarkable features of the disease is a tendency to involvement of the testes, ~~This most frequently occurs after~~ the affection of the salivary glands ~~has~~ subsided. The swelling may be great, and occasionally effusion takes place into the tunica vaginalis. ~~The orchitis is in some instances unilateral, involving the right testicle.~~ The inflammation increases for three or four days, and resolution takes place gradually. Occasionally there may be a muco-purulent discharge. In severe cases atrophy may follow. Orchitis is rarely seen before puberty.

A vulvo-vaginitis sometimes occurs in girls, and the breasts may become enlarged and tender. Involvement of the ovaries is rare.

Complications and Sequelæ.—Of these the cerebral affections are perhaps the most serious. As already mentioned, there may be delirium and high fever. In rare instances meningitis has been found. Hemiplegia and coma may also occur. A majority of the fatal cases are associated with meningeal symptoms. These, of course, are very rare in comparison with the frequency of the disease; yet, in the Index Catalogue, under this caption, there are six fatal cases mentioned. In some epidemics the cerebral complications are much more marked than in others. Acute mania has occurred, and there are instances on record of insanity following the disease.

Arthritis, ~~is an occasional complication.~~ Albuminuria, with convulsions, ~~has been described. Fatal cases have occurred from~~ acute uræmia, and Suppuration of the gland is an extremely rare complication in genuine ~~idiopathic~~ mumps. Gangrene has occasionally occurred. The special senses may be seriously involved. Many cases of deafness have been described in connection with or following mumps. ~~The deafness~~, unfortunately, may be permanent. Affections of the eye are rare, but atrophy of the optic nerve has been described.

The diagnosis of the disease is usually easy. The position of the swelling in front of and below the ear and the elevation of the lobe on the affected side definitely fix the locality of the swelling. In children inflammation of the parotid, apart from ordinary mumps, is excessively rare.

Treatment.—It is well to keep the patient in bed during the height of the disease. The bowels should be freely opened, and the patient given a light liquid diet. No medicine is required unless the fever is high, in

which case aconite may be given. Cold compresses may be placed on the gland, but children, as a rule, prefer hot applications. A pad of cotton wadding covered with oiled silk is the best application. Suppuration is almost unknown, and need not be dreaded, even though the gland become very tense. Should redness and tenderness develop, leeches may be used. With delirium and head symptoms the ice-cap may be applied. In a robust subject, unless the signs of constitutional depression are extreme, a free venesection may do good. For the orchitis, rest, with support and protection of the swollen gland with cotton-wool, is usually sufficient.

XI. WHOOPING-COUGH.

Definition.—A specific affection characterised by convulsive cough and a long-drawn inspiration, during which the "whoop" is produced.

Etiology.—The disease occurs in epidemic form, but sporadic cases appear in a community from time to time. It is directly contagious from person to person; but dwelling-rooms, houses, school-rooms, and other localities may be infected by a sick child. It is, however, in this way less infectious than other diseases, and is probably most often taken by direct contact. The nature of the virus is still doubtful, many organisms having been described in the sputum. The observations of Afanassjew in 1887 have been the most satisfactory. He has cultivated a short bacillus, which grows with well-marked characters, and, when inoculated into the trachea of animals, produces a catarrhal condition of the mucous membrane. Cornil and Babes* conclude that the organism has not characteristics sufficiently pronounced, or an influence on animals sufficiently characteristic, to enable us to say that it is specific. Epidemics prevail for two or three months, usually during the winter and spring, and have a curious relation to other diseases, often preceding or following measles, less frequently scarlet fever.

Children between the first and second dentition are commonly affected. Sucklings are, however, not exempt, and I have seen very severe attacks in infants under six weeks. It is stated that girls are more subject to the disease than boys. Adults and old people are sometimes attacked, and in the aged it may be a very serious affection. Many persons possess immunity against the disease, and, though frequently exposed, escape. Delicate anæmic children with nasal or bronchial catarrh are more subject to the disease than others. According to the United States Census Reports, the disease is more than twice as fatal in the negro race than in others.

Morbid Anatomy.—Whooping-cough itself has no special pathological changes. In fatal cases pulmonary complications, particularly broncho-pneumonia, are usually present. Collapse and compensatory em-

* Les Bactéries, 1890.

No doubt. Some of the more recent observations are more conclusive

simple catarrh ×

The urine is scanty & the specific gravity high (1022–1032), pale yellow & contain much uric acid

physema, vesicular and interstitial, are found, and the tracheal and bronchial glands are enlarged.

Symptoms.—Catarrhal and paroxysmal stages can be recognized. There is a variable period of incubation of from seven to ten days. In the *catarrhal stage* the child has the symptoms of an ordinary cold, which may begin with slight fever, running at the nose, injection of the eyes, and a bronchial cough, usually dry and sometimes giving indications of a spasmodic character. The fever is usually not high, and slight attention is paid to the symptoms, which are thought to be those of an ordinary cold. After lasting for a week or ten days, instead of subsiding, the cough becomes worse and more convulsive in character.

The *paroxysmal stage*, marked by the characteristic cough, dates from the first appearance of the "whoop." The fit begins with a series of from fifteen to twenty short coughs of increasing intensity, and then with a deep inspiration the air is drawn into the lungs, making the "whoop," which may be heard at a distance and from which the disease takes its name. This loud inspiratory sound may sometimes precede the series of spasmodic expiratory efforts. Several coughing-fits may succeed each other until a tenacious mucus is expectorated. This may be small in amount, but after a series of coughing-fits a considerable quantity may be expectorated. Not infrequently it is brought up by vomiting or by a combination of cough and regurgitation. There may be only four or five of these attacks in the day, or in severe cases they may recur every half-hour. During the attack the thorax is very strongly compressed by the powerful expiratory efforts, and, as very little air passes in through the glottis, there are signs of defective aëration of the blood; the face becomes swollen and congested, the veins are prominent, the eyeballs protrude, and the conjunctivæ become deeply engorged. Suffocation indeed seems imminent, when with a deep crowing inspiration air enters the lungs and the color is quickly restored. Children are usually terrified at the onset, and run at once to the mother or nurse to be supported during the attack. Few diseases are more painful to witness. In severe paroxysms vomiting is frequent and the sphincters may be opened.

An ulcer under the tongue is a very common event, and was thought at one time to be the cause of the disease.

During the attack, if the chest be examined, the resonance is defective in the expiratory stage, full and clear during the deep, crowing inspiration; but on auscultation during the latter there may be no vesicular murmur heard, owing to the slowness with which the air passes the narrowed glottis. Bronchial râles are occasionally heard.

Among circumstances which precipitate an attack are emotion, such as crying, and any irritation about the throat. Even the act of swallowing sometimes seems sufficient. In a close dusty atmosphere the coughing-fits are more frequent. After lasting for three or four weeks the attacks

become lighter and finally cease. In cases of ordinary severity the course of the disease is rarely under six weeks.

The complications and sequelæ of whooping-cough are important. During the extensive venous congestion hæmorrhages are very apt to occur in the form of petechiæ, particularly about the forehead, ecchymosis of the conjunctivæ, epistaxis, and occasionally hæmoptysis. Hæmorrhage from the bowels is rare. During the paroxysm convulsions may occur, due perhaps to the extreme engorgement of the cerebral cortex. Very rarely hemiplegia or monoplegia follows. Sudden death has been caused by extensive subdural hæmorrhage. Whooping-cough must be regarded as a very unusual cause of cerebral palsy in children. It was associated with three cases of my series of one hundred and twenty cases, but in none of them did the hemiplegia come on during the paroxysm, as in a case reported by S. West.

The persistent vomiting may induce marked anæmia and wasting. The pulmonary complications which follow whooping-cough are extremely serious. During the severe coughing-spells interstital emphysema may be induced, more rarely pneumothorax. I saw one instance in which rupture occurred, evidently near the root of the lung, and the air passed along the trachea and reached the subcutaneous tissues of the neck, a condition which has been known to become general. Broncho-pneumonia, with its accompanying collapse, is the most frequent pulmonary complication and carries off a large number of children. It may be simple, but in a considerable proportion of the cases the process is tuberculous. Pleurisy is sometimes met with and occasionally lobar pneumonia. Enlargement of the bronchial glands is very common in whooping-cough and has been thought to cause the disease. It may sometimes be sufficient to produce dulness upon the manubrium. ~~The heart stands the strain of whooping-cough remarkably well.~~ During the spasm the radial pulse is small, the right heart engorged, and during and after the attack the cardiac action is very much disturbed. ~~It is difficult to determine whether~~ serious damage ever results. Possibly some of the cases of severe valvular disease in children who have had neither rheumatism nor scarlet fever may be attributed to the terrible heart strain during a prolonged attack of whooping-cough. Renal complications are very uncommon. Sugar is occasionally found in the urine.

Diagnosis.—So distinctive is the "whoop" of the disease that the diagnosis is very easy; but occasionally there are doubtful cases, particularly during epidemics, in which a series of expiratory coughs occurs without any inspiratory crow.

Prognosis.—Taken with its complications, whooping-cough must be regarded as a very fatal affection. According to Dolan it ranks third among the fatal diseases of children in England, where the death-rate per million from this disease is five thousand annually. The younger the infant the greater is the probability of serious complications. The

Koplik regards the swelling about the face & eyes as an important sign of the heart strain

The patient should be isolated, and of the paroxysms are dall
severe rest in bed
fresh air, night & day, is a most essential element in
the treatment of the disease.

~~fresh air~~
~~see Ped. Soc. discus~~

Bromoform in doses of one to five ~~minims~~
suspended in syrup has been warmly
recommended of late.

deaths are chiefly among children of the poor and among delicate infants.

Treatment.—Parents should be warned of the serious nature of whooping-cough, the gravity of which is scarcely appreciated by the public. Particular care should be taken that children suspected of the disease are not sent to the public schools or exposed in any way so that other children can become contaminated. There is more reprehensible neglect in connection with this than with any other disease. The medicinal treatment of whooping-cough is most unsatisfactory. Like other infectious disorders it runs its course practically uninfluenced in a majority of cases by drugs. In the catarrhal stage when there is fever the child should be in bed and a saline fever mixture administered. If the cough is distressing, ipecacuanha wine and paregoric may be given. For the paroxysmal stage a suspiciously long list of remedies has been recommended, twenty-two in one popular text-book on therapeutics. If the disease is due, as seems probable, to a germ growing upon and irritating the bronchial mucosa, a germicidal plan of treatment seems highly rational and persistent attempts should be made to discover a suitable remedy. Quinine placed upon the tongue; resorcin in one-per-cent solutions, swabbed frequently on the throat; two or three grains of iodoform to an ounce of starch powder; a spray of carbolic acid—have all been warmly recommended. J. Lewis Smith advises the use of the steam atomizer with a solution of carbolic acid, chloride of potassium and bromide of potassium in glycerin. Jacobi regards belladonna as the most satisfactory remedy. He gives it in full doses, as much as one sixth of a grain of the root or the extract to a child of six or eight months three times a day. It should be given in sufficient doses to produce the cutaneous flush. For the nervous element in the disease antipyrin has been used with apparent success.

After the severity of the attack has mitigated and convalescence has begun, the child should be watched with the greatest care. It is just at this period that the fatal broncho-pneumonias are apt to develop. The cough sometimes persists for months and the child remains weak and delicate. Change of air should be tried. Such a patient should be fed with care, and given tonics and cod-liver oil.

XII. INFLUENZA (*La Grippe*).

Definition.—An infectious disease characterised by great prostration and often catarrh of the mucous membranes, particularly the respiratory and gastro-intestinal. There is a marked liability to serious complications, particularly pneumonia.

Epidemics appear at intervals and spread with extraordinary rapidity, so that in a few weeks an entire continent may be involved. The dis-

ease has been known for several centuries, and there have been within the past fifty years several extensive outbreaks, notably those of 1833, 1847–'48, and the recent outbreak in 1889–'90. Many of the epidemics have started in Russia, hence the name Russian fever. In October of 1889 it prevailed extensively in St. Petersburg. During November and December it spread to Germany, France, and western Europe, appearing in London about the end of December. Cases appeared in this country about Christmas, and the disease rapidly became epidemic.

Etiology.—The conditions which favor its development and rapid spread are unknown, and the exhaustive literature of the past year has not brought us nearer a solution of the problem. It appears to be independent of meteorological conditions. While some authorities hold that the affection is due to a miasmatic material in the atmosphere, others probably more correctly hold that it is due to a specific virus of the most intense infectiveness. Like other rapidly spreading diseases, it is conveyed along lines of travel. The bacteriological examinations which have been made in large numbers of cases leave us still in doubt, and the varied character of the germs found by reliable observers indicates that the true virus has not yet been detected. The pus organisms and the *diplococcus pneumoniæ* have been found oftenest, but these are widespread organisms and are probably not associated in a causative manner with the disease.

Morbid Anatomy.—Uncomplicated cases recover. In the delicate and aged alone do we see fatal results, and then only from the intensity of the fever or the profound depression. Injection and swelling of the pharyngeal and laryngeal mucosa, bronchitis, and a catarrhal condition of the stomach and intestines may be present.

The complications are very varied. Severe bronchitis, lobar and lobular pneumonia, and nephritis may exist.

Symptoms.—In many cases the attack closely resembles an ordinary catarrh with slight fever, dryness and swelling of the nasal mucosa, and then increase in the secretion. In the severer cases the coryza is subsidiary or absent, and the symptoms are those of an infection of varying grades of severity. A striking feature is the severe nervous manifestation at the outset, the headache, pain in the back and legs, and a general soreness as if bruised or beaten. With the exception of dengue and small-pox there is no affection in which these symptoms are more pronounced. Delirium may be marked. Associated with these is a prostration and cardiac weakness out of proportion to the intensity of the fever, and sometimes very alarming. The pulse is feeble, small, and intermittent. Death may result directly from heart-failure, as in cases mentioned by Wilks.

Serious nervous complications are marked *delirium* and *meningitis*, the latter usually in association with pneumonia. Bristowe has reported several cases of *abscess of the brain* following influenza. Peripheral neuritis was not very uncommon in the last epidemic. *Mental disorders* are

The elaborate reports of the Berlin Medical Society (Berlin 18) the Report of Parsons (Local Government Board Report 1894) and the work of Pfeiffer from Kochs Institute are the three most notable productions of the present last resolution

^ Epidemic of 1889-90 which began has returned each year with varying severity, lessening last winter (1894-95)

disease is highly contagious, and is probably spread only from the result to the sound ~~and not as formerly along the air~~ Independent of all meteorological conditions, ~~and~~ like other rapidly spreading affections it conveyed along lines of travel.

The bacillus ~~of~~ discovered by Pfeiffer, which is accepted by leading authorities as the cause of the disease, ~~Haemophilus~~ is a very small rod bacillus, ~~stained well in dilute~~ readily stained well in dilute methylene blue, or in dilute ~~fuchsin~~ Carbol-fuchsin in water. On culture media ~~it grows~~ red solution of ~~fuchsin~~ ~~in a thermostat at 37°C~~ Kills to. ~~Stains~~ ~~rods~~ on the presence of haemoglobin. The bacilli are present in enormous numbers in the nasal & bronchial secretions of patients, in the latter almost pure cultures. They persist often after the severe symptoms have subsided

See Sisly's book on Influenza - and Parsons's Local Government Board.

period of incubation is from one to four days; ~~of~~ present ~~from~~ two to four days

^ are more pronounced in influenza than in any other disorders except dengue & small pox

is common

^ Herpes, ~~diffuse~~ erythema ~~may~~ occurs ~~rarely~~ " petechiae ~~and~~ purpura have been described. Albuminuria is a frequent event, and cystitis may develop. Conjunctivitis ~~is~~ has been observed. Otitis media in rare instances of the neuritis have been observed. Acute otitis is common complication

pericarditis and pericarditis are rare complications. Persistent irregularity of the heart action, bradycardia tachycardia and pseudo-angina attacks have been present reported

The sputum is rusty ~~is~~ raised & brought up in little lumps or balls

In the aged & weak ~~the~~ ~~and~~ bronchio-pneumonia of both lower lobes ~~terminal event~~ - ~~high fever was a not unfrequent~~ - ~~terminal event~~ - complication

whole culture

~~Sequela~~ ~~diabetes may follow~~

The bacteriological diagnosis can be made by examining the sputum but cultures are ~~is~~ a rule necessary. sometimes

Isolation should be practised when possible, and old people should ~~stay~~ indoors be guarded against all possible sources of infection. The secretions, nasal & bronchial should be thoroughly disinfected

not infrequent. Inaptitude for mental exertion, depression of spirits, even insanity, may follow an attack.

Affections of the respiratory organs are the most serious. Many cases present an intense *bronchitis*, involving the large and small tubes and coming on with high fever, sometimes with delirium. An intense general bronchitis was common during the recent epidemic. In children it may be complicated with broncho-pneumonia. By far the most serious and fatal complication is *pneumonia*, which may follow the bronchitis, or set in with well-characterised symptoms. Sometimes the symptoms may at first be obscure and the pneumonia atypical. Thus, after an initial rigor, with some dyspnœa and high fever, the local signs may be obscure and it may not be until the third or fourth day, or even later, that the physical signs of a pneumonia are detected. The sputa may not be rusty until the fourth or fifth day. The crisis may be deferred or the defervescence may be by lysis. A considerable proportion of the cases, however, run a normal course. So far as I could see, there was nothing special or peculiar in the pneumonia; all the anomalies which have been mentioned as occurring in influenza are found in any large series of cases. Abscess of the lung may follow. Pleurisy is not an uncommon complication, and empyema may develop.

The gastro-intestinal symptoms may be marked; thus, with the initial fever, there may be nausea and vomiting. Diarrhœa is not uncommon; indeed, the brunt of the catarrhal process may fall upon the gastro-intestinal mucosa.

The *diagnosis* of the disease offers no difficulties when it occurs in epidemic form. Coryza is not always present, and the symptoms may be those of general fever with great prostration. In other instances the bronchitis may be an important feature. The severe prostration, fever, delirium, with the initial bronchitis, and occasionally epistaxis, may lead to the diagnosis of typhoid fever. The complications are, as a rule, readily recognised, though at first the symptoms of the pneumonia may be somewhat indefinite.

Treatment.—In every case the disease should be regarded as serious, and the patient should be confined to bed until the fever has completely disappeared. In this way alone can serious complications be avoided. From the outset the treatment should be supporting, and the patient should be carefully fed and well nursed. The bowels should be opened by a dose of calomel or a saline draught. At night ten grains of Dover's powder may be given. At the onset a warm bath is sometimes grateful in relieving the pain in the back and limbs, but great care should be taken to have the bed well warmed, and the patient should be given after it a drink of hot lemonade. If the fever is high and there is delirium, small doses of antipyrin may be given and an ice-cap applied to the head. The medicinal antipyretics should be used with caution, as profound prostration sometimes develops in these cases. Too much stress should not be

laid upon the mental features. Delirium may be marked even with slight fever. In the cases with great cardiac weakness stimulants should be given freely, and during convalescence strychnia in full doses.

The intense bronchitis, pneumonia, and other complications should receive their appropriate treatment. The convalescence requires careful management, and it may be weeks or months before the patient is restored to full health. A good nutritious diet, change of air, and pleasant surroundings are essential. The depression of spirits following this disease is one of its most unpleasant and obstinate features.

XIII. DENGUE.

Definition.—An acute infectious disease of tropical and subtropical regions, characterised by febrile paroxysms, pains in the joints and muscles, and sometimes a cutaneous rash.

The disease was first noted in Java toward the close of the last century, and it was probably described by Rush in 1780. During this century many epidemics of it have been reported, particularly in India, Africa, and the southern United States. S. H. Dickson gave the most satisfactory account of the disease as it appeared in Charleston in 1828. Since that time there have been three or four wide-spread epidemics, confined chiefly to the Gulf States and rarely extending beyond the 32nd parallel.

Etiology.—Many observers regard it as contagious, and Dickson mentions in the history of his own household that during the epidemic of 1828 all were attacked, whereas in the epidemic of 1850 he and the cook (the only ones remaining in his household of those who composed it in 1828) alone escaped. The question can scarcely yet be considered settled. The disease spreads from place to place, and is conveyed by ships and along railroads. It is remarkable among epidemics as practically affecting all members in a community who have not been protected by a previous attack. Matas, in his excellent account,* states that one attack does not protect from subsequent infection. It attacks all races equally. The disease is stated to attack animals.

McLaughlin, of Texas, has found in the blood of patients a micrococcus, which he regards as the special agent and has been able to cultivate. The slides which he kindly sent me show a streptococcus-like organism, but it is impossible yet to speak definitely as to the relations which it bears to the disease. If it be true that animals are subject to the affection, the subject could be conclusively worked out during the next epidemic. Some writers have held that dengue is only a modified form of yellow fever. It has in some instances preceded the development of this disease.

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* Keating's Encyclopedia of Diseases of Children, vol. i.

As the disease is never fatal, no observations have been made upon its pathological anatomy.

Symptoms.—The period of incubation is from three to five days, during which the patient feels well. The attack sets in suddenly with headache, chilly feelings, and intense aching pains in the joints and muscles. The fever rises gradually and may reach as high as 106° or 107°. The pulse is rapid and there are the other phenomena associated with acute fever—loss of appetite, coated tongue, slight nocturnal delirium, and concentrated urine. In the initial stage there may be an erythematous rash. In a majority of the cases the pains in the muscles, joints and bones are of a most aggravated character, and the patients speak of them as of a boring or breaking character, hence the popular name "break-bone fever." The large and small joints are affected, sometimes in succession, and they become swollen, red, and painful. The pains shift about, and in some cases cutaneous hyperæsthesia has been noted. In some instances there is a tendency to hæmorrhage, from either the nose, lungs, stomach, or bowels. Eugene Foster speaks of having seen black vomit, similar to that of yellow fever, and in three instances alarming hæmorrhage from the bowels, which in one case persisted for three months and caused death.

The fever gradually reaches its height by the third or fourth day, and the patient enters upon the apyretic period, which may last from two to four days, and in which he feels prostrated and stiff. At this time, in a large number of cases, an eruption is common which, judging from the description, has nothing distinctive, being at times macular, like measles, at others, diffuse and scarlatiniform, or papular, or lichen-like. In other instances the rash has been described as urticarial, or even vesicular. A second paroxysm of fever then occurs, and the pains return. Certain writers describe inflammation and hyperæmia of the mucous membrane of the nose, mouth, and pharynx. Enlargement of the lymph-glands is not uncommon, and may persist for weeks after the disappearance of the fever. Convalescence is often protracted, and there is a degree of mental and physical prostration out of all proportion to the severity of the primary attack. By far the most distressing symptom is the pain, which all who have experienced the disease speak of as agonising and intolerable, and more severe than that experienced in any other acute fever.

Complications are rare. Insomnia and occasionally delirium, resembling somewhat the alcoholic form, have been observed. A relapse may occur even as late as two weeks. Briefly, the course of the disease may be described as consisting of a febrile paroxysm of three or four days; a remission of variable duration, which may be wanting; and a second paroxysm of about three days. The average duration of a moderate attack is from seven to eight days.

The *diagnosis* of the disease rarely offers any special difficulties, prevailing as it does in epidemic form, and attacking all classes indiscriminately. Isolated cases might be mistaken at first for acute rheumatism.

Southern physicians say that occasionally yellow fever and dengue may be confounded.

Treatment.—This is entirely symptomatic. Quinine is stated to be a prophylactic, but on insufficient grounds. Hydrotherapy may be employed to reduce the fever. The salicylates or antipyrin may be tried for the pains, which usually, however, require opium. During convalescence iodide of potassium is recommended for the arthritic pains, and tonics are indicated.

XIV. CEREBRO-SPINAL MENINGITIS.

Definition.—A specific infectious disease, occurring sporadically and in epidemics, characterised by inflammation of the cerebro-spinal meninges and a clinical course of great irregularity.

The affection is known by the names of malignant purpuric fever, petechial fever, and spotted fever.

Etiology.—Since its recognition in Geneva in the early part of this century, numerous epidemics have been described ~~in Europe and in America, the full details of which are to be found in Stillé's elaborate article.*~~ In Europe it is remarkable with what frequency the disease has occurred in garrisons. In this country the disease was first seen in Massachusetts in 1806, since which date there have been epidemics in various localities at irregular intervals.

During the civil war, according to Smart's report, comparatively few deaths were caused by this disease.

Sporadic cases occur from time to time in the larger cities and country districts on this continent. After the first epidemic in Montreal in 1873 occasional cases occurred. In Philadelphia, since its appearance in 1863, there have been cases reported every year in the mortality bills. Without autopsy the diagnosis of many of these cases is extremely doubtful; but there can be no question that the disease, though rare, still lingers. Judging from my own experience in three of the hospitals of that city, and from the fact that in five years I saw only three instances, I would regard it as very much less frequent than the reports of the Health Office would seem to indicate.

The disease has broken out simultaneously in regions far distant from each other.

The epidemics have occurred most frequently in winter and spring. Neither soil nor locality has any special influence. The concentration of individuals, as in large barracks, seems to be specially favorable.

Children are much more susceptible to the disease than adults, though the susceptibility has differed in different epidemics. In certain places

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~~* System of Medicine, Philadelphia, vol. i, 1885.~~

monograph (1867) and the elaborate section (pp 409-553) in Vol I of Joseph Jones works give full details of the American Epidemics.

favoring the occurrence
We are still ignorant of the conditions ~~underlying~~ of epidemics. The presence of the micrococcus lanceolatus in sporadic ~~cases~~ as well as epidemic forms, had led to the belief that the disease may be due to this organism, the morbid manifestations of which are so varied, and which is present in only a percentage of all persons. Strümpell has suggested that there may ~~have been~~ the spine connection with coryza & epidemic meningitis; the infection occurring directly from the nose. Flexner & Barker suggest that the intestine may be the infection-atrium; but neither of these views explain the ~~sporadic~~ lanceolatus rapid development of epidemics dependent apparently upon local conditions

fibrin

(1) Study of the Lmaconing epidemic. Am. Journ. Med. Sci. 1892

children alone have been affected; in others the disease has been chiefly among adults. It attacks males and females alike.

Certain epidemics have been most prevalent in country districts. In 1873 the disease prevailed along the valley of the Ottawa, in villages and country places, much more severely than in the cities of Montreal and Ottawa.

Over-exertion, prolonged marching in the heat, depressing mental or bodily surroundings, and the misery and squalor of the large tenement-houses in cities are predisposing causes.

The disease is not directly contagious; it is probably not transmitted by clothing or the excretions.

The nature of the virus is as yet unknown. In the meningeal exudation there is now found in many cases the lance-shaped coccus, similar in all respects to the pneumococcus. In other instances this microbe has been associated with the ordinary pus organisms. Cornil and Babes conclude that cerebro-spinal meningitis may be caused by several different, often associated, forms of micro-organisms, of which the lance-shaped coccus of Pasteur is the most common.

Morbid Anatomy.—In malignant cases there may be no characteristic changes, for the patient may die before exudation occurs. In well-marked cases the meninges of the brain and cord are inflamed. The following abstract of one of the Montréal cases, in which death occurred about the fifth day, gives a good idea of the condition in this disease: The brain contained an excessive amount of blood. The dural sinuses and all the veins and arteries were engorged. Some of the veins of the pia were as large as goose-quills. On the cortex there was much lymph beneath the arachnoid on either side of the longitudinal fissure—more on the right than on the left hemisphere. At the base there was a purulent exudate about the chiasma and inner parts of the Sylvian fissure, but none on the pons or medulla. There was no lymph in the course of the middle cerebral arteries. The ventricles contained serous exudate; the walls were not softened. The gray matter of the brain was deeply congested, but presented neither hæmorrhages, spots, nor softening. In the spinal cord the veins of the pia were engorged. On the posterior surface, from the cervical enlargement to the cauda equina, was a thick layer of grayish-yellow, lympho-purulent exudation, which in places produced irregular bulging of the arachnoid membrane. There were no changes in the thoracic or abdominal viscera. This picture corresponds closely with that presented by five other cases which I have examined. In one case, however, the amount of exudation on the hemispheres was large, and the convolutions were covered with a thick creamy pus. Foci of hæmorrhage and of encephalitis occur in some cases. The formation of abscess has been occasionally described. The involvement of the ventricles is less than in tuberculous meningitis. In the cases which I have seen the exudation, as is usual in the secondary meningeal inflammations, was most

abundant on the cortex. The exudation may extend along the lymph-sheaths of the cranial nerves, particularly the auditory and optic. In long-standing cases the inflammatory processes appear more chronic. There are thickening and adhesion of the membranes, areas of cortical softening or of atrophy, and, in some instances, hydrocephalus. The changes in the other organs are those associated with fever. In the malignant cases there may be hæmorrhages into the skin and on the serous membranes. Pneumonia, pleurisy, endocarditis, dysentery and nephritis have been described. The spleen varies in size according to the period of the disease at which death has occurred. When the fever has been intense it is enlarged.

Symptoms.—Cases differ remarkably in their characters. Many different forms have been described. These are perhaps best grouped into three classes:

1. **Malignant Form.**—This fulminant or apoplectic type occurs with variable frequency in epidemics. It may occur sporadically. The onset is sudden, usually with violent chills, headache, somnolence, spasms in the muscles, great depression, moderate elevation of temperature, and feeble pulse, which may fall to fifty or sixty in the minute. Usually a purpuric rash develops. In a Philadelphia case in 1888 a young girl, apparently quite well, died within twenty hours of this form. There are cases on record in which death has occurred within a shorter time. Stillé tells of a child of five years, in whom death occurred after an illness of ten hours; and refers to a case reported by Gordon, in which the entire duration of the illness was only five hours.

2. **Ordinary Form.**—The stage of incubation is not known. The disease usually sets in suddenly. There may be premonitory symptoms: headache, pains in the back, and loss of appetite. More commonly, the onset is with headache, severe chill, and vomiting. The temperature rises to 101° or 102°. The pulse is full and strong. An early and important symptom is a painful stiffness of the muscles of the neck. The headache increases, and there are photophobia and great sensitiveness to noises. Children become very irritable and restless. In severe cases the contraction of the muscles of the neck sets in early, the head is drawn back, and, when the muscles of the back are also involved, there is opisthotonos. The pains in the back and in the limbs may be very severe. The motor symptoms are most characteristic. Tremor of the muscles may be present, with tonic or clonic spasms in the arms or legs. Rigidity of the muscles of the back or neck is very common, and the patient lies with the body stiff and the head drawn so far back that the occiput may be between the shoulder-blades. Except in early childhood convulsions are not common. Strabismus is a frequent and important symptom. Spasm of the muscles of the face may also occur. Cases have been described in which the general rigidity and stiffness was such that the body could be moved like a statue. Paralysis of the trunk mus-

Orthotonos is most common which is more common than Opisthotonos

cles is rare, but paralysis of the muscles of the eye and the face is not uncommon.

Of sensory symptoms, headache is the most dominant and persists from the outset. It is chiefly in the back of the head, and the pain extends into the neck and back. There may be great sensitiveness along the spine, and in many cases there is marked hyperæsthesia.

The psychical symptoms are marked. Delirium occurs at the outset, occasionally of a furious and maniacal kind. The patient may display marked erotic symptoms. The delirium gives place in a few days to stupor, which, as the effusion increases, deepens to coma.

The temperature is irregular and variable. Remissions occur frequently, and there is no uniform or typical curve during the disease. In some instances there has been little or no fever. In other cases the temperature may reach 105° or 106°, or, before death, 108°. The pulse may be very rapid in children; in adults it is at first usually full and strong. In some cases it is remarkably slow, and may not be more than fifty or sixty in the minute. Sighing respirations and Cheyne-Stokes breathing are met with in some instances. Unless there is pneumonia the respirations are not often increased in frequency.

The cutaneous symptoms of the disease are important. Herpes ~~labialis~~ occurs with even greater frequency than in pneumonia or in intermittent fever. The petechial rash, which has given the name spotted fever to the disease, is very variable. Stillé states that of ninety-eight cases in the Philadelphia Hospital, no eruption was observed in thirty-seven. In the Montreal cases petechiæ and purple spots were common. They appear to have been more frequent in the epidemics on this continent than in Europe. The petechiæ may be numerous and cover the entire skin. An erythema or dusky mottling may be present. In some instances there have been rose-colored hyperæmic spots like the typhoid rash. Urticaria or erythema nodosum, ecthyma, pemphigus and in rare instances gangrene of the skin have been noted.

As already stated, vomiting may be a special feature at the outset; but, as a rule, it gradually subsides. In some instances, however, it persists and becomes the most serious and distressing of the symptoms. Diarrhœa is not common. The bowels are usually confined. The abdomen is not tender. In acute cases the spleen is usually enlarged.

The urine is sometimes albuminous and the quantity may be increased. Glycosuria has been noted in some instances, and in the malignant forms hæmaturia.

The course of the disease is extremely variable. Hirsch rightly states that it may range between a few hours and several months. More than half of the deaths occur within the first five days. In favorable cases, after the symptoms have persisted for five or six days, improvement is indicated by a lessening of the spasm, reduction of the fever, and a return of the intelligence. Sudden fall in the temperature is of bad omen. Con-

valescence is extremely tedious, and may be interrupted by complications and sequelæ to be noted.

3. **Anomalous Forms.**

(*a*) *Abortive Type.*—The attack sets in with great severity, but in a day or two the symptoms subside and convalescence is rapid. Strümpell would distinguish between this abortive variety, which sets in with such intensity, and the mild ambulant cases described by certain writers. He reports a case in which the meningeal symptoms set in with the greatest intensity and persisted for four days, the temperature rising to 40·9° C. On the fifth day the patient entered upon a rapid and satisfactory convalescence. In the mild cases, as distinguished from the abortive, the patients complain of headache, nausea, sensations in the back and limbs, and stiffness in the neck. There is little or no fever, and only moderate vomiting. These cases have been met with, and could be recognised only during the prevalence of an epidemic.

(*b*) *An intermittent type* has been observed in many epidemics, and is recognised by von Ziemssen and Stillé. It is characterised by exacerbations of fever, which may recur daily or every second day, or follow a curve of an intermittent or remittent character. The pyrexia resembles that of pyæmia rather than malaria.

(*c*) *Chronic Form.*—Heubner states that this is a relatively frequent form, though it does not seem to be recognised by many writers on the subject. An attack may be protracted for from two to five or even six months, and may cause the most intense marasmus. The attack consists of a series of recurrences of the fever, and may present the most complex symptomatology. It is not improbable that these protracted cases depend upon chronic hydrocephalus or abscesses of the brain. This form differs distinctly from the intermittent type. A very remarkable instance of it is described by Worthington,* in which the disease lasted for fourteen weeks.

Complications.—Pleurisy and pericarditis are not uncommon.

Pneumonia is described as frequent in certain epidemics. Immermann found, during the Erlangen epidemic, many instances of the combination of pneumonia with meningitis, but it does not seem possible to determine whether, in such instances, pneumonia is the primary disease and the meningitis secondary, or *vice versa*. The frequency with which inflammation of the meninges of the brain complicates pneumonia has already been mentioned. It is not impossible that the pneumococcus is responsible for both affections. Arthritis has been the most frequent complication in certain epidemics. Many joints are affected simultaneously, and there are swelling, pain, and exudation, sometimes serous, sometimes purulent. This was first observed by James Jackson, Sr., in the epidemic which he described.

* Canada Medical and Surgical Journal, vol. xiv.

and parotitis

Uveitis has been observed

Among the important sequelæ are those affecting the special senses. Blindness may result from optic neuritis with atrophy. Keratitis with ulceration may develop. This may also occur in the meningitis following pneumonia. Iritis is less common.

Still more serious are the ear symptoms, particularly in children. Deafness very often follows inflammation of the labyrinth; the result, no doubt, of the direct extension of the inflammation along the auditory nerve. In children this not infrequently leads to deaf-mutism. Von Ziemssen states that in the deaf and dumb institutions of Bamberg and Nuremberg, in 1874, almost all the pupils had become deaf from epidemic cerebro-spinal meningitis.

Headache may persist for months or years after an attack. Chronic hydrocephalus develops in certain instances in children. The symptoms of this are "paroxysms of severe headache, pains in the neck and extremities, vomiting, loss of consciousness, convulsions, and involuntary discharges of fæces and urine" (von Ziemssen). Von Ziemssen regards chronic hydrocephalus as by no means a rare sequela. Mental feebleness and aphasia have occasionally been noted.

Paralysis of individual cranial nerves or of the lower extremities may persist for some time. In some of these cases unquestionably there may be peripheral neuritis, as Mills suggested.

Diagnosis.—There are several affections with which cerebro-spinal meningitis is likely to be confounded:

(*a*) *Tuberculous Meningitis.*—In sporadic cases it is sometimes impossible to determine the nature of a case in the absence of local tuberculous disease. Retraction of the neck and spasms of the muscles of the arms and legs are not nearly so marked and prominent in tuberculous meningitis. Herpes also is rare, and the pulse is more irregular. There is rarely petechial eruption. When the disease is prevailing epidemically this factor is of the greatest help in the diagnosis.

(*b*) *Pneumonia.*—The meningeal complication of this disease is most commonly confined to the cerebrum. As the cortex is chiefly involved, there may be a good deal of motor spasm and tremor, but rarely is there retraction of the muscles of the neck or opisthotonos. In sporadic cases, as has been said, it may be quite impossible to decide whether the pneumonia has complicated the meningitis or the meningitis the pulmonary affection. The bacteriological examination gives no clue, as the pneumococcus is found in both situations.

(*c*) *With other Acute Infectious Diseases.*—Both typhus and typhoid present symptoms which closely simulate cerebro-spinal meningitis. On several occasions at the Montreal General Hospital cases have been sent into the ward with the diagnosis of cerebro-spinal fever. These cases showed high fever, delirium, retraction of the neck, spasm, and tremor of the muscles, and had not the post-mortem examination revealed typhoid lesions and only cerebro-spinal congestion the diagnosis would not have

been corrected. I am sure that many of the cases sent into the health offices as cerebro-spinal fever are instances of the cerebral form of typhoid.

I have already referred to the fact that the malignant form of small-pox may be mistaken for cerebro-spinal meningitis.

It could scarcely be possible to confound tetanus with this disease.

Prognosis.—Hirsch states that the mortality has ranged in various epidemics from 20 to 75 per cent. In children the death-rate is much higher than in adults. Cases with deep coma, repeated convulsions, and high fever rarely recover. The outlook in the protracted cases is not good, though Heubner gives an instance of a lad of seven, who was ill from the end of February until the end of June, with repeated recurrences, was worn to a skeleton, and yet completely recovered.

Treatment.—The high rate of mortality which has existed in most epidemics indicates the futility of the various therapeutical agents which have been recommended. When we consider the nature of the local disease and the fact that, so far as we know, simple or tuberculous cerebro-spinal meningitis is invariably fatal, we may wonder rather that recovery follows in any well-developed case.

In strong robust patients the local abstraction of blood by wet cups on the nape of the neck relieves the pain. General bloodletting is rarely indicated. Cold to the head and spine, which was used in the first epidemics by New England physicians, is of great service. A bladder of ice to the head, or an ice-cap, and the spinal ice-bag may be continuously employed. The latter is very beneficial. Judging from the beneficial effects of the general bath in typhoid with pronounced cerebro-spinal symptoms, hydrotherapy should be systematically employed if the temperature is above 102½°. In private practice the cold-pack or sponging may be substituted. If any counter-irritation is thought necessary, the skin of the back of the neck may be lightly touched with the Paquelin thermo-cautery. Blisters, which have been used so much, are of doubtful benefit and should not be employed. Of internal remedies opium may be given freely, best as morphia hypodermically. Stillé recommends either a grain of opium every hour in severe cases or every two hours in cases of moderate severity; von Ziemssen advises the hypodermic of morphia, from one third to one half grain in adults. Mercury has no special influence on meningeal inflammation. Iodide of potassium is warmly recommended by some writers. Quinine in large doses, ergot, belladonna and Calabar bean have had advocates. Bromide of potassium may be employed in the milder cases, but it is not so useful as morphia to control the spasms.

The diet should be nutritious, consisting of milk and strong broths while the fever persists. Many cases are very difficult to feed, and Heubner recommends forced alimentation with the stomach-tube. These cases seem to bear stimulants well, and whisky or brandy may be given freely when there are signs of a failing heart.

There are

Two groups of cases, ~~(1)~~ ~~the~~ ~~cases~~ caused by the Klebs-Loeffler
1- bacillus, as those caused by the Streptococcus pyogenes. The
former are the most numerous, and comprise the large proportion
of the cases of malignant diphtheria, while the latter occurs in a smaller
number, ~~but~~ is usually a secondary affection,
~~but~~ gives a more hopeful prognosis. ~~but~~ Clinically & anatomically
~~the~~ the Membranous angina associated with the streptococcus alone,
~~a true diphtheria may be~~ ~~severe while the~~ even the most complete paralysis may follow. It may present all
1-/ the features of true diphtheria, even to the profound depression of paralysis

~~In the present condition of our knowledge it is difficult to give a~~

~~That~~ clinical & bacteriological status is not satisfactory.
~~Column~~ On the one hand there are cases ~~where the~~ of membranous
angina which the bacteriologist finding the Klebs-Loeffler bacillus calls true diphtheria, on
the other hand, there are cases of membranous sloughing angina
~~which the physician~~ called diphtheria by the physician. ~~but which the bacteriologist~~
~~not finding~~ in the absence of the Klebs-Loeffler organism are called by the
bacteriologist pseudo-diphtheria or diphtheroid angina. ~~It~~
~~would appear that. Not only the most and constitutional~~ disturbances
~~but even the post-diphtheritic paralyses may follow~~
~~as well as streptococcus angina~~.

The term diphtheroid may well be used for the present to
designate the forms in which the Klebs-Loeffler bacillus is
not present. Though usually milder the most severe
constitutional disturbances & even the paralyses may follow
these so called pseudo-diphtheritic processes.

XV. DIPHTHERIA.

Definition.—A specific infectious disease, characterized by a local fibrinous exudate, usually upon a mucous membrane, and by constitutional symptoms of varying intensity. The presence of the Klebs-Loeffler bacillus may be regarded as the etiological criterion by which true diphtheria may be distinguished from other forms of pseudo-membranous inflammation.

Historical Note.—The disease was known to Aretæus and Galen. Epidemics occurred throughout the middle ages. It appeared early among the settlers of New England, and accounts are extant of epidemics in this country in the seventeenth and eighteenth centuries. Huxham and Fothergill gave excellent descriptions of the disease. An admirable account was given by Samuel Bard,* of New York, in 1770, whose essay is one of the most solid contributions made to medicine in America. It was reserved for Pierre Bretonneau, of Tours, to grasp the fact that *angina suffocativa*, "*cynanche maligna*," the "putrid" and other forms of malignant sore throat were one and the same disease, to which he gave the name "diphthérite."

Etiology.—The disease is endemic in the larger centres of population, and becomes epidemic at certain seasons of the year. It is a remarkable fact that while other contagious diseases have diminished within the past decade, diphtheria, particularly in cities, has increased. It is by no means confined to the poorer districts, but occurs in the houses of the better classes, particularly when the plumbing is defective. The disease is, however, not confined to cities. It has prevailed with great severity in country districts, in which indeed the affection seems to be specially virulent. The relation between imperfect drainage and the diphtheria poison has not yet been satisfactorily determined. Perhaps, as Thorne suggests, the faulty conditions produce sore throat of a benign character, which, as in scarlet fever, affords a soil suitable for inoculation by the diphtheria germ, when present in the air. Drains, too, he thinks may retain the virus received through the sputa and dejecta of the sick. This author states that no prevalence of diphtheria has ever been definitely traced to polluted water.

Diphtheria is a highly contagious disease, readily communicated from person to person. The poison is given off in the pharyngeal secretion and in the saliva, but not in the breath. No disease of temperate regions proves more fatal to physicians and nurses. There seems to be particular danger in the examination and swabbing of the throat, for in the gagging, coughing, and spluttering efforts the patient may cough mucus and flakes of membrane into the physician's face. The virus attaches itself to the clothing, the bedding, and the room in which the patient has lived, and

* Transactions of the American Philosophical Society, vol. i, Philadelphia, 1770.

has, in many instances, displayed great tenacity. The disease may be transmitted by inoculation. The contagion does not seem to be widely diffused in the neighborhood of the patient. At the Montreal General Hospital we rarely had cases develop in the wards adjacent to those in which there were diphtheria patients.

There is a wide-spread belief in the profession that the disease may be communicated from animals. There is in calves a contagious pseudo-membranous affection which is said to be communicable to man. Cows are not known to be affected spontaneously. In the epidemics in which the contagion has been traced to the milk, it is more probable that the virus has been accidentally mixed with it than that the cows were themselves diseased. Cats are subject to a pseudo-membranous disease, and there are many cases on record in which children appear to have caught diphtheria from them. On the other hand, I know of one case in which a cat died of angina and intense pseudo-membranous colitis, and the children who nursed it did not take the disease; and of a second case, in which a pet cat had coryza, difficult breathing, fever, and enlarged cervical glands, and here too the children were not affected. The so-called diphtheria of fowls is apparently not associated with the same germ as the human diphtheria.

Of predisposing causes *age* is one of the most important. Very young children are rarely attacked, but Jacobi states that he has seen three instances of the disease in the newly born. Between the third and the fifteenth year a large majority of the cases occur. In this period the greatest number of deaths is between the second and the fifth years. Girls are attacked in larger numbers than boys, probably because they are brought into closer contact with the sick. Adults are frequently affected. The disease is most prevalent in the cold autumn weather.

Caillé regards as special predisposing elements in children, enlarged tonsils, chronic naso-pharyngeal catarrh, carious teeth, and an unhealthy condition of the mucous membrane of the mouth and throat.

Epidemics vary in intensity. While in some the affection is mild and rarely fatal, in others it is characterized by wide extension of the membrane, and shows a special tendency to attack the larynx.

The Specific Germ.—The bacillus originally described by Klebs and more thoroughly studied by Loeffler appears to be the specific virus. It is found in the pseudo-membranes, not in the subjacent mucosa, or in the blood, or in the internal organs. It is a non-motile bacillus, varying from 2·5 to 3 μ in length, and from 0·5 to 0·8 μ in thickness. It appears as a straight or slightly bent rod with rounded ends. Irregular bizarre forms, such as rods with one or both ends swollen, are, however, not uncommon. The bacillus stains in sections or cover-glass specimens by Gram's method. It is best cultivated on blood serum and bouillon. The colonies are large, elevated, grayish-white, with an opaque centre. Welch and Abbott also state that it grows well on potato; but the growth is invisible or indicated

Calves, cats, fowls are subject to contagious membranous inflammation diseases which are however not identical with diphtheria in man & are not communicable. Thin

As in other infectious disorders individual susceptibility plays an important rôle. Very many of these if passed through not only do but even if there in where throats the bacilli lodge & grow.

The secondary pseudo-membranous inflammations diphtheria caused usually by the streptococcus, and attack debilitated persons, the subjects of fever particularly scarlet-fever & typhoid, and measles.

The micro-organisms

only by a dry thin glaze. It multiplies readily in milk. Although it forms no spores, it is a very persistent bacillus, and cultures have been made from membrane preserved for five months in a dry cloth. The cultures inoculated into the trachea of animals produce a well-marked diphtheritic exudation with development of the bacilli and secondary involvement of the lymph-glands, in which remarkable necrotic areas occur, with fragmentation of the nuclei (Flexner). Brieger and Fränkel have separated from the cultures a tox-albumin, which, injected into animals, produces paralysis, nephritis, and albuminuria. This point tends strongly to confirm the view that this bacillus is really the infective agent in the disease. It is one of the most virulent poisons known, and when injected in a sufficiently small though fatal dose, there may be no symptoms for days, and the animal may not develop the paralysis for weeks or even months after the injection. A point of very great interest is the fact that cultures from cases vary in virulence, and this is in accord with the remarkable variation in the intensity of different epidemics and different cases. As a rule there is a correspondence between the virulence of the bacilli and the gravity of the case.

Associated with the Klebs-Loeffler bacillus are other pathogenic bacteria, which probably play an important *rôle* in the complications of the disease. Thus streptococci and staphylococci are frequently present in the exudate, and to their invasion through the abraded mucosa are due the secondary suppurations and inflammations of serous surfaces, and to the aspiration of the streptococci into the lungs the common and fatal broncho-pneumonia.

Diphtheria may then be said to be caused by the Klebs-Loeffler bacillus. The production of a false membrane is the local or primary effect; the constitutional symptoms are due to the absorption of the poison in varying doses, while the secondary inflammations are associated with the invasion of the ubiquitous pus organisms.

Pseudo-diphtheritic Processes.—Many substances have the power of exciting pseudo-membranous or croupous inflammation, the exudate of which is not distinguishable from that of diphtheria. Some of them are non-microbic, as steam, ammonia, and chlorine; others are dependent upon micro-organisms, and must be distinguished from true diphtheria.

(*a*) There are cases of pseudo-membranous angina, associated with which is a bacillus identical, morphologically and in its behavior on culture media, with the Klebs-Loeffler bacillus, but which is not pathogenic—i. e., does not produce the tox-albumin, and is harmless when inoculated. Whether this is an attenuated form, as Roux and Yersin hold, is not yet settled. This complicates the question of diagnosis. A patient in my ward presented a thin, grayish pseudo-membrane over the tonsils and fauces, without fever and without constitutional disturbance. Non-pathogenic bacilli, identical with those of true diphtheria, were found by Welch

and Abbott. We need additional information upon the occurrence of this form and its relation to the virulent bacillus.

(*b*) The pseudo-membranous angina of the eruptive fevers is an affection distinct, etiologically at least, from true diphtheria. In a majority of all these cases, particularly in scarlet fever, the Klebs-Loeffler bacillus is absent, and this is in accord with the fact that scarlatinal angina rarely communicates diphtheria, and is still more rarely followed by paralysis.

Streptococci and staphylococci are present in the membranes in these cases. Late in the disease infection with the *bacillus diphtheriæ* may occur, and it is probable that under these circumstances alone is the angina followed by symptoms of paralysis.

Morbid Anatomy.—A majority of the cases die of the faucial or of the laryngeal disease. The exudation may occur in the mouth and cover the inner surfaces of the cheeks; it may even extend beyond the lips on to the skin. This was met once in thirty autopsies at the Montreal General Hospital. The amount of exudation varies in different cases. Usually the tonsils and the pillars of the fauces are swollen and covered with the false membrane. More commonly, in the fatal cases, the exudation is very extensive, involving the uvula, the soft palate, the posterior nares, and the lateral and posterior walls of the pharynx. These parts are covered with a dense pseudo-membrane, in places firmly adherent, in others beginning to separate. In extreme cases the necrosis is advanced and there is a gangrenous condition of the parts. The membrane is of a dirty-greenish or gray color, and the tonsils and palate may be in a state of necrotic sloughing. The erosion may be deep enough in the tonsils to open the carotid artery, or a false aneurism may be produced in the deep tissues of the neck. The nose may be completely blocked by the false membrane, which may also extend into the conjunctivæ and through the Eustachian tubes into the middle ear. In cases of laryngeal diphtheria the exudate in the pharynx may be extensive. In many cases, however, it is slight upon the tonsils and fauces and abundant upon the epiglottis and the larynx, which may be completely occluded by false membrane. In severe cases the exudate extends into the trachea and to the bronchi of the third or fourth dimension. This occurred in nearly half of my thirty Montreal autopsies.

In all these situations the membrane varies very much in consistency, depending greatly upon the stage at which death has occurred. If death has occurred early, it is firm and closely adherent; if late, it is soft, shreddy, and readily detached. When firmly adherent it is torn off with difficulty and leaves an abraded mucosa. In the most extreme cases, in which there is extensive necrosis, the parts look gangrenous. In fatal cases the lymphatic glands of the neck are enlarged and there is a general infiltration of the tissues with serum; the salivary glands, too, may be swollen. In rare instances the membrane extends to the gullet and stomach.

Histological Changes.—We owe largely to the labors of Wagner, Wei-

gert, and more particularly to the splendid work of Oertel, our knowledge of the minute changes which take place in diphtheria. The following is a brief abstract of the views of the last-named author:

The diphtheritic poison induces first a necrosis or death of cells with which it comes in contact, particularly the superficial epithelium and the leucocytes. The deeper cells of the mucosa and of the other parts reached by the poison may also be affected. The second change is hyaline transformation of the dead cells, or, as Weigert terms it, the production of coagulation-necrosis. The bacilli excite inflammation with the migration of leucocytes, which are destroyed by the poison and undergo the hyaline change. The superficial epithelial layers undergo a similar alteration, and what we know as the false membrane represents an aggregation of dead cells, most of which have undergone the transformation into hyaline material. This is in all probability a conservative process by which, in a measure, the poison is localized and prevented from reaching the deeper structures. The laminated condition of the exudate is probably produced by the inflammation of different layers. The formation of these foci of necrobiosis, starting from the epithelium and proceeding inward, is, according to Oertel, the distinguishing characteristic of diphtheria. The action of the poison is by no means confined to the superficial mucosa on which the bacilli grow. Although they do not themselves penetrate deeply, the contiguous bronchial glands show extensive foci of necrosis. In severe cases these necrotic areas are found in the internal organs, in the solitary glands of the intestines, and in the mesenteric glands.

The blood-vessels may themselves be much altered and the capillaries may show extensive hyaline degeneration. Every one of the histological changes described by Oertel in human diphtheria may be paralleled in the experimental disease induced by the Klebs-Loeffler bacillus, particularly the necrotic areas in the deep-seated organs, associated in the lymph-glands with a remarkable fragmentation of the nuclei.

The changes in the *other organs* are variable. When death has occurred from asphyxia there is general congestion of the viscera.

Capillary bronchitis, areas of collapse, and patches of broncho-pneumonia are almost constantly found in fatal cases. In very malignant cases the blood may be fluid. Fibrinous coagula may be found in the heart, but the wide-spread idea that they may cause sudden death is erroneous. Myocardial changes are not infrequent, and in certain cases sudden death is due to heart-failure in consequence of degeneration of the muscle-fibres. Endocarditis is extremely rare. It was not present in one of my thirty autopsies. The serous membranes often show ecchymoses. The kidneys present parenchymatous changes, such as are associated with acute febrile affections. There may, however, be acute nephritis. The spleen and liver show the usual febrile changes. The spleen is, however, not always enlarged.

Symptoms.—The period of incubation varies. In the cases of acci-

dental inoculation the duration is from two to three days. In cases in which the disease is contracted in the usual way it is from seven to twelve days. The initial symptoms are those of an ordinary febrile attack: slight chilliness, fever, and aching pains in the back and limbs. In mild cases these symptoms are trifling, and the child may not feel ill enough to go to bed. Usually the temperature rises to 103° or even more. There may be convulsions at the outset. In an attack of ordinary severity there is at first redness of the fauces, and the child complains of slight difficulty in swallowing. The exudate first appears upon the tonsils. It may be difficult to distinguish the patchy diphtheritic pellicle from the exudate in the tonsillar crypts. The swelling of the throat increases and the glands of the neck become involved. Usually by the third day the membrane has covered the tonsils, and crept on to the pillars of the fauces, and even to the uvula, which is now thickened and œdematous and completely fills the space between the swollen tonsils. The false membrane may extend also to the posterior wall of the pharynx. At first grayish white in color, it changes to a dirty gray, often a yellowish gray. The membrane is firmly adherent, and if removed leaves a bleeding, somewhat eroded surface. New membrane rapidly forms in place of that removed. The general condition of the patient, in a case of moderate severity, is fairly good. The temperature is not necessarily high, and in the absence of complications the range is from 102° to 103°.

At this stage, say the fourth or fifth day of the disease, the condition of the child is favorable. The pulse and temperature are not much above 100°; the throat symptoms are not of extreme severity; and the constitutional depression is not extreme. The symptoms may then abate and the swelling of the neck diminish. The false membrane separates, and by the eighth or tenth day the throat is clear and convalescence begins.

Deviations from this favorable course result either from extension of the local disease or from systemic infection.

(1) **Extension.**—The inflammation may pass into the posterior nares, obstructing the respiration, causing a very acrid and fœtid discharge, and usually a marked aggravation of the constitutional symptoms. The glandular inflammation is usually more intense; due, as Jacobi points out, to the greater richness of the nasal mucosa in lymphatics, which thus favors systemic infection. Though usually secondary, nasal diphtheria may be primary. It greatly increases the danger in any case. From the nose the inflammation may extend through the tear-ducts to the conjunctivæ and into the antra. In these cases the disease is more apt to involve the ears, through the Eustachian tubes, causing otitis media and perforation of the drum.

Extension of the inflammation downward into the larynx is by far the most serious complication of the disease. It is particularly dangerous in children, because it produces what is known as diphtheritic croup. The symptoms are identical with those of ordinary membranous croup.

Nasal diphtheria.

Laryngeal diphtheria — croup.

In many instances the pharynx is but slightly involved. There may be only a trifling patch upon one tonsil. The first symptoms of laryngeal affection are huskiness of the voice, a brazen cough, and stridulous, noisy inspiration and expiration. With increasing obstruction the respiration becomes greatly embarrassed, the lower thoracic zone and the lower sternum are drawn in with each inspiration, and the supra-clavicular and intercostal spaces are depressed. Too often there is a gradually deepening cyanosis, and the child dies asphyxiated.

The exudation may extend into the trachea and bronchi, which become lined by a uniform sheeting of false membrane. It is not always easy to say, during life, whether exudation has taken place into these parts. In the performance of tracheotomy, when membrane is found in the trachea the outlook is generally bad. Occasionally the tracheal and bronchial membrane is coughed up as a definite mould.

(2) **Systemic Infection.**—In mild cases of diphtheria the constitutional disturbance is very slight. There may even be extensive local disease without great constitutional disturbance. As a rule, however, the general symptoms bear a definite proportion to the severity of the local disease. There are rare instances in which from the outset, even before the pharyngeal symptoms are at all well-marked, the constitutional prostration is extreme, the pulse frequent and small, the fever high, the nervous phenomena are pronounced; and the patient sinks in two or three days, overwhelmed by the severity of the poison. In some of these cases the exudation is chiefly nasal; in others the exudation is marked, but the throat symptoms are by no means extensive. It is specially to be noted that the temperature may not be raised; it may even be subnormal. The malignant diphtheria of this kind is fortunately rare. The severe systemic symptoms appear more commonly at a later date, when the pharyngeal symptoms are at their height. They are invariably met when the disease is extensive and when there is a sloughing fœtid condition in the pharynx causing an offensive odor of the breath. The lymphatic glands are greatly enlarged; the pallor is extreme, the color of the face an ashen gray, the pulse is rapid and feeble, and the temperature sinks below normal. In the most aggravated form there are gangrenous processes in the throat. If life is prolonged there may even be extensive sloughing in the tissues of the neck.

There are, of course, many variations in the above clinical picture. The cases may be so mild as scarcely to be recognized. Such cases, indeed, are often mistaken for ordinary lacunar tonsillitis. There are also certain anomalous forms which may be mentioned; cases which come on insidiously, with a tonsillitis of so mild a grade that it may be overlooked, and which is followed by a diphtheritic croup or a severe broncho-pneumonia. In rare instances the disease may almost be termed chronic, since the membrane remains upon the tonsils and pharynx for weeks.

There are instances in which well-characterized pseudo-membrane occurs on the tonsils and fauces without much swelling and without severe constitutional disturbance. A young woman came to my clinic at the University Hospital, Philadelphia, whose tonsils, soft palate and uvula were covered with a smooth, firm, grayish-white pseudo-membrane. There was little or no swelling of the parts, the membrane was clean, its edges were well defined, and on removal of the membrane the mucosa beneath bled freely. The exudation had all the characters of false membrane. The patient had scarcely any constitutional disturbance. The temperature was below 100°, and she had not felt ill enough to go to bed. After persisting for eight or nine days the membrane was gradually removed, and she recovered without any ill effects. The membrane may appear first upon the mucous membrane of the mouth, or it may attack the conjunctiva or the external auditory meatus. Occasionally the vulva, prepuce, or anus is first attacked. In rare cases the skin is involved. When the disease is epidemic, external wounds and abrasions are apt to be infected. In recently delivered women the disease may attack the uterus or vulva.

Complications and Sequelæ.—Local complications, hæmorrhage from the nose or throat, may occur in the severe ulcerative cases. Skin rashes are not infrequent, particularly the diffuse erythema. Occasionally there is urticaria and in the severe cases purpura. The pulmonary complications are extremely important. Fatal cases almost invariably show capillary bronchitis with broncho-pneumonia and large patches of collapse. In very bad cases, with extensive sloughing, the septic particles may reach the bronchi and excite gangrenous processes which may lead to severe and fatal hæmorrhage.

Renal complications are common. ~~In my experience~~ *albuminuria* is present in all severe cases. It may cause with the usual tests only a slight turbidity of the urine, the ordinary febrile albuminuria. In others there is a large amount of albumen, curdy in character. It is only when the albumen is in considerable quantity and associated with epithelial or blood casts that the condition indicates parenchymatous nephritis and is alarming. The nephritis may be quite early in the disease. It sets in occasionally with complete suppression of the urine. In comparison with scarlet fever the renal changes lead less frequently to general dropsy. In the large number of cases of diphtheria which came under observation at the Montreal General Hospital, I call to mind only one or two instances in which the nephritis was associated with general anasarca. Arthritis is an occasional complication just as in scarlet fever. Endocarditis, pericarditis and pleurisy are very rare events.

Of the sequelæ of diphtheria, *paralysis* is by far the most important. This can be experimentally produced in animals, as already noted, by the inoculation of the toxic albumen produced by the bacilli. The paralysis occurs in a variable proportion of the cases, ranging from 10 to 15 and

In rare instances
The membrane may persist for weeks, even after the patient is up & about.

less in children than in adults

proportionately
It is less frequent in children than in adults.

palate

Facial paralysis may develop.

Heart Symptoms are not uncommon

even to 20 per cent. It is strictly a sequel of the disease, coming on usually in the second or third week of convalescence. Occasionally it comes as early as the seventh or eighth day of the disease. It may follow very mild cases; indeed, the local disease may be so trifling that the onset of the paralysis alone calls attention to the true nature of the trouble.

The disease is a toxic neuritis, due to the absorption of the poison, and, like other forms of multiple neuritis, has an extremely complex symptomatology, according to the nerves which are affected. The paralysis may be local or general.

Of the local paralyses the most common is that which affects the palate. This gives a nasal character to the voice, and, owing to a return of liquids through the nose, causes a difficulty in swallowing. This may be the only symptom. The velum is seen to be relaxed and motionless, and the sensation in it is also much impaired. The affection may extend to the constrictors of the pharynx, and deglutition become embarrassed. Within two or three weeks or even a shorter time the paralysis disappears. In many cases the affection of the palate is only part of a general neuritis. Of other local forms perhaps the most common are paralysis of the eye-muscles, intrinsic and extrinsic. There may be strabismus, ptosis, and loss of power of accommodation. The neuritis may be confined to the nerves of one limb, though more commonly the legs or the arms are affected together. Very often with the palatal paralysis is associated a weakness of the legs without definite palsy but with loss of the knee-jerk.

~~By far the most important local paralysis is met with in connection with the heart.~~ There may be great retardation, even to thirty beats in the minute. Bradycardia and tachycardia may alternate in the same patient. Heart-failure and fatal syncope may occur at the height of the disease or during convalescence. If they occur during the fever, the child, perhaps after an exaggeration of symptoms, presents an unusual pallor. The pulse becomes weak and rapid, but may fall to fifty, forty, or even lower. The extremities are cold, the temperature sinks, and death takes place, with all the features of collapse, within a few hours. More frequently the fatal collapse comes during convalescence, even as late as the sixth or seventh week after apparent recovery. The attack may set in abruptly, perhaps following a sudden exertion. More commonly there have been symptoms pointing to disturbed cardiac rhythm, or even fainting-spells. In some instances vomiting has preceded the serious cardiac attack. There may be no physical signs other than slight increase in the cardiac dulness and a gallop-rhythm indicating dilatation. These symptoms were formerly ascribed to cardiac thrombosis or to endocarditis. Possibly in some of the cases the result is due, as pointed out by Mosler and Leyden, to an infectious myocarditis, but in a majority of the cases the symptoms are probably due to a neuritis of the cardiac nerves.

The multiple form of diphtheritic neuritis is not uncommon. It may begin with the palatal affection, or with loss of power of accommodation

and loss of the tendon reflexes. This last is an important sign, which, as Buzzard and R. L. MacDonnell have shown, may occur early, but is not necessarily followed by other symptoms of neuritis. There is paraplegia, which may be complete or involve only the extensors of the feet. The disease may extend and involve the arms and face and render the patient entirely helpless. The muscles of respiration may be spared. The chief danger in these severer forms comes from the involvement of the heart and of the muscles of respiration; but the outlook is in many cases not so bad as the patient's condition would indicate. Of thirteen cases collected by Cadet de Gassicourt six died. The sphincters may be involved, though they are often spared.

Diagnosis.—Early in the disease it may be difficult to distinguish diphtheria from follicular tonsillitis. In mild cases it is sometimes impossible. In diphtheria the exudation forms a definite, uniform patch, situated on a deeply congested area of mucosa. In follicular tonsillitis, when the exudate oozes and if the material from the crypts coalesces, it may be extremely difficult to make a diagnosis. If the process is confined to the tonsils the nature of the case may be dubious. If, however, it extends to the pillars of the fauces and if laryngeal symptoms develop, all doubts are removed. Occasionally the true character of the disease is not manifested until a paralysis develops during convalescence. It is in these cases that the detection of the Klebs-Loeffler bacillus will be of the greatest service in making clear the diagnosis. Cover-glass preparations may be made from the membrane. Cultures should be made in the blood-serum and bouillon mixture, and inoculations performed on animals. Unfortunately, these procedures can scarcely be carried out except in well-equipped laboratories, and a ready and certain clinical method, such as we have for the tubercle bacillus, is not yet available.

Between diphtheritic laryngitis and croup a majority of writers now hold that there is no essential difference; but it is more rational to believe that there is a non-specific pseudo-membranous laryngitis. This is a point, too, which bacteriology may be able to clear up. In several cases which have been examined the Loeffler bacillus has been present. The diagnosis between the two conditions is by no means easy. In the diphtheritic form, however, there is almost invariably exudation upon the tonsils or soft palate. Between scarlet fever and diphtheria there may be some confusion The question has already been discussed.

The recognition of the diphtheritic paralysis offers no difficulties.

Prognosis.—In hospital practice the disease is very fatal, owing largely to the fact that only the severer forms are admitted. In country places epidemics may display an appalling virulence and kill nearly all the children attacked. In cases of ordinary severity the outlook is usually good. Death results from involvement of the larynx, septic infection, sudden heart-failure, diphtheritic paralysis, occasionally from uræmia, and sometimes from broncho-pneumonia developing in the convalescence.

Bernhardt.

paralysis

Treatment.—Prophylaxis.—Cases of diphtheria should invariably be isolated. Physicians should insist that other children in the family be kept from school and from mingling with their schoolmates. All clothing and utensils which have been used by the patient should be thoroughly disinfected. For this purpose the clothing may be soaked for twenty-four hours and then boiled in a two-per-cent carbolic solution. For disinfecting the room sulphur fumigation may be employed, taking care that the air is rendered moist, or the floor and walls should be thoroughly scoured with corrosive-sublimate solution.

Caillé has urged the importance of a careful inspection of the tonsils and mouth in children, special attention being paid to the care of the teeth and to the tonsils, which, if swollen and irregular, should be removed. In persons liable to exposure Loeffler recommends the use of antiseptic mouth-washes, such as sublimate (1 to 10,000), chlorine-water (1 to 1,100), or thymol. After recovery at least two weeks should elapse before the child is permitted to mingle with others or to return to school.

Recently it has been announced that the blood-serum of animals rendered secure against the diphtheritic bacillus and its products can nullify the effects of the poison of diphtheria.

General Treatment.—The two indications in the treatment of diphtheria are to prevent or limit the local development of the bacilli and to combat the effects of the toxic materials which they produce.

The usual measures should be employed to insure thorough cleanliness and ventilation and to diminish the danger of infection. The air should be kept moist with steam. Mild cases require but little treatment. A fair quantity daily of liquid food, with ice to suck, and a gargle of chlorate of potash are sufficient. In more severe cases the greatest care should be taken to maintain the strength of the patient. The food should be given at stated intervals. Stimulants will be required early and should be given freely. In very young children with the pharyngeal involvement swallowing is painful, and the giving of food by the mother or nurse is a continuous struggle. In such instances nutritive enemata should be used.

We are still without a remedy capable of combating in any way the effects of the poisonous tox-albumins. Two remedies are warmly recommended—the tincture of the perchloride of iron, which may be given hourly in four or five drop doses to a child of three, and the corrosive sublimate, of which a child a year old may take as much as half a grain a day. Personally, I much prefer the perchloride of iron; and I cannot say that I have seen from the mercury, given either as the bichloride or as calomel, the specially good effects which many writers describe. I have not seen any good follow the administration of the sulphides or the benzoates or quinine in large doses. Peroxide of hydrogen has been warmly recommended.

Local Treatment.—Diphtheria is a local disease at first, and by the production of poisonous substances causes the severe systemic symptoms.

Hence the importance of local treatment. It is not well to attempt forcibly to remove the false membranes, though some writers recommend that they should be scraped off. As far as possible thorough cleanliness and disinfection of the fauces should be insured by repeatedly spraying, either with carbolic acid, corrosive sublimate (two grains to the pint), chlorine-water, boric acid, Condy's fluid, salicylic acid or peroxide of hydrogen (50 per cent solution), or local application of sulphur with iodoform is recommended. The tonsils and fauces may be thoroughly swabbed every hour or two with a solution of carbolic acid (♏xv) and perchloride of iron (ʒ ijss.) in glycerin (℥ j) and water (℥ j). Agents which are believed to dissolve the membrane are lactic acid, which may be employed with lime-water (two drachms to six ounces) and trypsin (thirty grains to the ounce).

Pepsin has also been used, and the vegetable pepsin, which may be mixed with water and glycerin.

Nasal diphtheria requires prompt and thorough disinfection of the passages. The best solutions are those recommended by Jacobi—chloride of sodium, saturated boric acid, or one part of bichloride of mercury, thirty-five of chloride of sodium, and one thousand of water, or the one per cent solution of carbolic acid. The solution may be applied with a syringe or a spray. To be effectual the injection must be properly given. The nurse should be instructed to pass the nozzle of the syringe horizontally, not vertically; otherwise the fluid will return through the same nostril. In refractory children there is sometimes great difficulty in giving these injections, in which case suppositories of boric acid may be employed, but they are not efficient substitutes.

When the larynx becomes involved a steam tent may be arranged upon the bed, so that the child may breathe an atmosphere saturated with moisture. If the dyspnœa becomes urgent, an emetic of sulphide of zinc or ipecacuanha may be given. When the signs of obstruction are marked, however, there should be no delay in the performance of intubation or tracheotomy. The diphtheritic paralysis requires rest in bed, and the avoidance of sudden exertion, particularly in those cases in which the heart-rhythm is disturbed. In the chronic forms with wasting, massage, electricity and strychnine are invaluable aids. If swallowing becomes very difficult, the patient must be fed with the stomach-tube, which is very much preferable to feeding per rectum.

XVI. ERYSIPELAS.

Definition.—An acute, contagious disease, characterized by a special inflammation of the skin caused by streptococci.

Etiology.—Erysipelas is a wide-spread affection, endemic in most communities, and at certain seasons epidemic. We are as yet ignorant of

The Loeffler solution may be used.

of 2012 cases collected by Anders 1214
~~Anders~~ occurred during the first five months
of the year. April had the largest number of
cases

is the streptococcus pyogenes, with
which the streptococcus erysipelatos appears to be
identical. The symptoms are due in great part to the
toxins, the more serious visceral complications are
the result of secondary infection

the atmospheric or telluric influences which favor the diffusion of the poison.

It is particularly prevalent in the spring of the year. This was very noticeable in the Philadelphia Hospital, in which the erysipelas wards were usually empty except in the spring and autumn months. The affection prevails extensively in old ill-ventilated hospitals and institutions in which the sanitary conditions are defective. With the improved sanitation of late years the number of cases has materially diminished. It has been observed, however, to break out in new institutions under the most favorable hygienic circumstances. Erysipelas is both contagious and inoculable; but, except under special conditions, the poison is not very virulent and does not seem to act at any great distance. It can be conveyed by a third person. The poison certainly attaches itself to the furniture, bedding, and walls of rooms in which patients have been confined.

The disposition to the disease is wide spread, but the susceptibility is specially marked in the case of individuals with wounds or abrasions of any sort. Recently delivered women and persons who have been the subject of surgical operations are particularly prone to it. A wound, however, is not necessary, and in the so-called idiopathic form, although it may be difficult to say that there was not a slight abrasion about the nose or lips, in very many cases there certainly is no observable external lesion.

Chronic alcoholism, debility, and Bright's disease are predisposing agents. Certain persons show a special susceptibility to the disease, and it may recur in them repeatedly. There are instances, too, of a family predisposition to the disease.

The specific agent of the disease appears to be a streptococcus which has been very thoroughly studied by Koch and Fehleisen. It was believed at first to have specific and peculiar morphological properties, but it is now generally held that it cannot be distinguished by any biological or chemical tests from the *streptococcus pyogenes*.

Morbid Anatomy.—Erysipelas is a simple inflammation. In its uncomplicated forms there is seen, post mortem, little else than inflammatory œdema. Investigations have shown that the cocci are found chiefly in the lymph-spaces and most abundantly in the zone of spreading inflammation. In the uninvolved tissue beyond the inflamed margin the micrococci are to be found in the lymph-vessels, and it is here, according to Metschnikoff and others, that an active warfare goes on between the leucocytes and the cocci (phagocytosis). In more extensive and virulent forms of the disease there is usually suppuration. It is stated that the inflammation may pass inward from the scalp through the skull to the meninges. This I have never seen, but in one case I traced the extension from the face along the fifth nerve to the meninges, where an acute meningitis and thrombosis of the lateral sinus were excited.

The visceral complications of erysipelas are numerous and important. The majority of them are of a septic nature. Infarcts occur in the lungs,

spleen, and kidneys, and there may be the general evidences of pyæmic infection.

Some of the worst cases of malignant endocarditis are secondary to erysipelas; thus of twenty-three cases three occurred in connection with this disease. Septic pericarditis and pleuritis also occur.

As just mentioned, the disease may in rare cases extend and involve the meninges. Pneumonia is not a very common complication.

Acute nephritis is also met with. It is often ingrafted upon an old chronic trouble.

Symptoms.—The following description applies specially to erysipelas of the face and head, the form of the disease which the physician is most commonly called upon to treat.

The *incubation* is variable, probably from three to seven days.

The stage of *invasion* is often marked by a rigor, and followed by a rapid rise in the temperature and all the characters of an acute fever. When there is a local abrasion, the spot is slightly reddened; but if it is idiopathic, there is seen within a few hours slight redness over the bridge of the nose and on the cheeks. The swelling and tension of the skin increase and within twenty-four hours the external symptoms are well marked. The skin is smooth, tense, and œdematous. It looks red, feels hot, and the superficial layers of the epidermis may be lifted as small blebs. The patient complains of an unpleasant feeling of tension in the skin; the swelling rapidly increases; and during the second day the eyes are usually closed. The first-affected parts gradually become pale and less swollen as the disease extends at the periphery. When it reaches the forehead it progresses as an advancing ridge, perfectly well defined and raised; and often, on palpation, hardened extensions can be felt beneath the skin which is not yet reddened. Even in a case of moderate severity, the face is enormously swollen, the eyes are closed, the lids greatly œdematous, the ears thickened, the scalp is swollen, and the patient's features are quite unrecognizable. The formation of blebs is common on the eyelids, ears, and forehead. The cervical lymph-glands are swollen, but are usually masked in the œdema of the neck. The temperature keeps high without marked remissions for four or five days and then defervescence takes place by crisis. The general condition of the patient varies much with his previous condition of health. In old and debilitated persons, particularly in those addicted to alcohol, the constitutional depression from the outset may be very great. Delirium is present, the tongue becomes dry, the pulse feeble, and there is marked tendency to death from toxæmia. In the majority of cases, however, even with extensive disease, the constitutional disturbance, considering the height of the fever range, is slight. The mucous membrane of the mouth and throat may be swollen and reddened. The erysipelatous inflammation may extend to the larynx, but the severe œdema of this part occasionally met with is commonly due to extension of the inflammation from without inward.

The general mortality in hospitals
~~practice~~ is about 7 per cent., in private
practice about 4. per cent. (anders)
Arnold Karsh.

There are cases in which the inflammation extends from the face to the neck, and over the chest, and may gradually migrate or wander over the greater part of the body (*E. migrans*).

The close relation between the erysipelas coccus and the pus organisms is shown by the frequency with which suppuration occurs in facial erysipelas. Small cutaneous abscesses are common about the cheeks and forehead and neck, and beneath the scalp large collections of pus may accumulate. Suppuration seems to occur more frequently in some epidemics than in others, and at the Philadelphia Hospital one year nearly all the cases in the erysipelas wards presented local abscesses.

Complications.—Meningitis is rare. The cases in which death occurs with marked brain symptoms do not usually show, post mortem, meningeal affection. The delirium and coma are due to the fever, or to toxæmia.

Pneumonia is an occasional complication. Ulcerative endocarditis and septicæmia are more common. Albuminuria is almost constant, particularly in persons over fifty. True nephritis is occasionally seen. Da Costa has called attention to curious irregular returns of the fever which occur during convalescence without any aggravation of the local condition.

The diagnosis rarely presents any difficulty. The mode of onset, the rapid rise in fever, and the characters of the local disease are quite distinctive. Acute necrosis of bone may sometimes be regarded as erysipelas, a mistake which I once saw made in connection with the lower end of the femur.

Prognosis.—Healthy adults rarely die. In the new-born, when the disease attacks the navel, it is almost always fatal. This is probably an acute septic infection. In alcoholic subjects and in the aged erysipelas is a serious affection, and death may result either from the intensity of the fever or, more commonly, from toxæmia. The wandering or ambulatory erysipelas, which has a more protracted course, may cause death from exhaustion.

Treatment.—Isolation should be strictly carried out, particularly in hospitals. A practitioner in attendance upon a case of erysipelas should not attend cases of confinement.

The disease is self-limited and a large majority of the cases get well without any internal medication. I can speak definitely on this point, having, at the Philadelphia Hospital, treated many cases in this way. The diet should be nutritious and light. Stimulants are not required except in the old and feeble. For the restlessness, delirium, and insomnia, chloral or the bromides may be given; or, if these fail, opium. When fever is high the patient may be bathed or sponged, or, in private practice, if there is an objection to this, antipyrin or antifebrin may be given.

Of internal remedies believed to influence the disease, the tincture of the perchloride of iron has been highly recommended. At the Montreal

General Hospital this was the routine treatment, and doses of half a drachm to a drachm were given every three or four hours. I am by no means convinced that it has any special action; nor, so far as I know, has any medicine, given internally, a definite control over the course of the disease.

Of local treatment, the injection of antiseptic solutions at the margin of the spreading areas has been much practised. Two per cent solutions of carbolic acid, the corrosive sublimate and the biniodide of mercury have been much used. The injection should be made not into but just a little beyond the border of the inflamed patch. F. P. Henry has treated a large number of cases at the Philadelphia Hospital with the latter drug, and this mode of practice is certainly most rational.

Of local applications, ichthyol is at present much used. The inflamed region may be covered with salicylate of starch. Perhaps as good an application as any is cold water, which was highly recommended by Hippocrates.

XVII. SEPTICÆMIA AND PYÆMIA.

1. SEPTICÆMIA.

Definition.—A general febrile infection, without foci of suppuration, which results from the absorption of toxic materials produced by bacteria. The organisms producing septicæmia are, as a rule, those of suppuration—namely, the forms of streptococci and staphylococci.

Clinical Forms.*—(*a*) *Fermentation Fever.*—This is also known as the resorption fever, aseptic fever, or after fever, and is the simplest of all wound complications. It is the febrile process which is produced after transfusion or the injection of pepsin into the blood. The term fermentation fever was employed by Bergman, as he held that it was caused by the absorption of the fibrin ferments. This fever may follow an injury or operation, particularly if there has been necrosis of the superficial tissues by the solutions used in the dressing. It may also follow the extravasation of blood, particularly when under pressure or tension.

The fever, which appears a few hours after the injury or operation, is not preceded by a chill. It usually reaches its height rapidly, sometimes rising to 103° or 104°. The constitutional disturbance is not great, and it subsides spontaneously in from one to three days. This form is ranked as a septicæmia, since the ferment acts in a manner similar to the toxins produced by micro-organisms. It is not yet certain that bacteria do not play an important part in its production.

(*b*) *Sapræmia.*—This is a septic intoxication caused by the ptomaines produced in wounds by the putrefactive bacteria. There are various forms of these organisms; some are bacilli, others belong to the proteus group.

* I follow here the division in Senn's Principles of Surgery.

Cryptogenic septicemia

Infection . . intoxication

Medical

1. General streptococcus infn.
2. Pneumococcus
3. Typhoid fever.
4. Gas bacillus. - gangrene.
5. anthrax.
6. N (?)
7. Colon bacillus.
8. Tub.
9. Tetanus
10. Proteus infection

In their growth, chemical poisons (toxins) are produced, and under the term sapræmia is included the group of symptoms caused by the absorption of these toxins from any local focus of putrefaction.

The symptoms vary with the dose absorbed. Twenty-four hours, or later, after the injury or operation a chill initiates the constitutional disturbance; the fever rises rapidly, reaching 103° or 104°; the pulse is quick, and there may, in severe cases, be great prostration. Nervous symptoms are common—headache, restlessness, and delirium. The tongue is dry, often glazed, and there may at first be gastric irritation. The clinical picture is that of a severe infection. Three conditions must be present in this form of sepsis—dead tissue, infection of this dead tissue with putrefactive bacteria, and a sufficient time to have enabled the putrefactive bacteria to produce a toxic quantity of ptomaines (Senn). The necrotic tissue may be the blood-clot in a wound, the tissues in the interior of the uterus after parturition, or tissues bruised and rendered necrotic by injury or by the action of cold, heat, or chemical substances.

The outlook in sapræmia depends much upon the dose of the poison which has been absorbed and the possibility of removing and cleansing the infected focus.

(*c*) *Progressive Septicæmia.*—In this the septic intoxication is not the result of the bacteria of putrefaction, but organisms enter the blood from some local septic focus. "The intoxication in this form of sepsis is not only caused by ptomaines which are produced at the primary seat of infection, but ptomaines are also produced in the blood by the microbes which it contains" (Senn). The pus microbes are the most frequent cause of this form of septicæmia, and reach the blood either through the wall of the blood-vessels or through the lymph-channels.

The clinical features of this form are well seen in the cases of puerperal septicæmia or in dissection wounds, in which the course of the infection may be traced along the lymphatics. The symptoms usually set in within twenty-four hours, and rarely later than the third or fourth day. There is a chill or chilliness, with moderate fever at first, which gradually rises and is marked by daily remissions and even intermissions. The pulse is small and compressible, and may reach 120 or higher. Gastro-intestinal disturbances are common, the tongue is red at the margin, and the dorsum is dry and dark. There may be early delirium or marked mental prostration and apathy. As the disease progresses there may be pallor of the face or a yellowish tint. Capillary hæmorrhages are not uncommon.

The outlook is always serious. In severe cases death may occur within twenty-four hours, and in fatal cases life is rarely prolonged for more than seven or eight days. On post-mortem examination there may be no focal lesions in the viscera, and the seat of infection may present only slight changes. The spleen is enlarged and soft, the blood may be extremely dark in color, and hæmorrhages are common, particularly on the serous surfaces. Neither thrombi nor emboli are found.

2. PYÆMIA.

Definition.—A general disease, characterized by recurring chills and intermittent fever and the formation of abscesses in various parts, all of which result from the contamination of the blood by products arising from a focus contaminated by the bacteria of suppuration.

Etiology.—As a rule, the disease follows extension of suppuration about a wound or the collection of pus in some part. It was thought at first that the pus itself was taken up by the blood. Virchow showed the important part played by thrombosis and embolism. The works of Lister, Klebs, Pasteur, Koch, and others have demonstrated the important *rôle* of micro-organisms in the disease. The pus microbes are the *streptococcus pyogenes* and forms of *staphylococci*. The streptococcus is most frequently found in the pus at the primary seat and in the metastatic abscesses.

The process which takes place is as follows: In a suppurating wound, for example, the pus organisms induce coagulation-necrosis in the smaller vessels with the production of thrombi and purulent phlebitis. The entrance of pus organisms in small numbers into the blood does not necessarily produce pyæmia. Commonly the transmission to various parts from the local focus takes place by the fragments of thrombi which pass as emboli to different parts, where if the conditions are favorable the pus organisms excite suppuration. A thrombus which is not septic or contaminated, when dislodged and impacted in a distant vessel, produces only a simple infarction; but, coming from an infected source and containing pus microbes, an independent centre of infection is established wherever the embolus may lodge. These independent suppurative centres in pyæmia, known as *embolic* or *metastatic abscesses*, have the following distribution:

(*a*) In external wounds, in osteo-myelitis, and in acute phlegmon of the skin, the embolic particles very frequently excite suppuration in the lungs, producing the well-known wedge-shaped pyæmic infarcts; but in some cases the infected particles pass through the lungs, and there are foci of inflammation in the heart and kidneys.

(*b*) Suppurative foci in the territory of the portal system, particularly in the intestines, produce metastatic abscesses in the liver with or without suppurative pyle-phlebitis.

(*c*) An interesting form of medical pyæmia is produced by malignant endocarditis—the arterial pyæmia of Wilks—in which, as a result of inflammation of the endocardium (either secondary to suppurative disease elsewhere, or following the infection of pneumonia or of certain general diseases), showers of infected thrombi are conveyed from the vegetations in the left heart and produce multiple abscesses in the spleen, kidneys, intestines, brain, and even in the skin.

(*d*) There are cases of so-called *idiopathic pyæmia* in which the pri-

mary focus of the disease is not apparent, but in which there are multiple abscesses in various parts of the body.

Symptoms.—In a case of wound infection, prior to the onset of the characteristic symptoms, there may be signs of local trouble, and, if a discharging wound, the pus may change in character. The onset of the disease is marked by a severe rigor, during which the temperature rises to 103° or 104° and is followed by a profuse sweat. These chills are repeated at intervals, either daily or every other day. In the intervals there may be slight pyrexia. The constitutional disturbance is marked and there are loss of appetite, nausea, and vomiting, and, as the disease progresses, rapid loss of flesh. Transient erythema is not uncommon. Local symptoms usually develop. If the lungs become involved there are dyspnœa and cough. The physical signs may be slight. Involvement of the pleura and pericardium is common. The tint of the skin is changed; at first pale and white, it subsequently becomes bile-tinged. The spleen is enlarged, and there may be intense pain in the side, pointing to perisplenitis from embolism. Usually in the rapid cases a typhoid state is gradually developed, and the patient dies comatose.

In the chronic cases the disease may be prolonged for months; the chills recur at long intervals, the temperature is irregular, and the condition of the patient varies from month to month. The course is usually slow and progressively downward.

Diagnosis.—Pyæmia is a disease frequently overlooked and often mistaken for other affections.

Cases following a wound, an operation, or parturition are readily recognized. On the other hand, the following conditions may be overlooked:

Osteo-myelitis.—Here the lesion may be limited, the constitutional symptoms severe, and the course of the disease very rapid. I recall two instances in which the actual cause of the trouble was discovered only at the post-mortem.

So, too, acute septic infection may follow *gonorrhœa* or a *prostatic abscess.*

Cases are sometimes confounded with *typhoid fever*, particularly the more chronic instances, in which there are diarrhœa, great prostration, delirium, and irregular fever. The spleen, too, may be enlarged.

In some of the instances of *ulcerative endocarditis* the diagnosis is very difficult, particularly in what is known as the typhoid type of this disease, in contradistinction to the septic. In *acute miliary tuberculosis* the symptoms occasionally resemble those of septicæmia, more commonly those of typhoid fever.

The *post-febrile arthritides*, such as occur after scarlet fever and gonorrhœa, are really instances of mild septic infection. The joints may sometimes proceed to suppuration and pyæmia develop. So, also, in *tuberculosis of the kidneys* and *calculous pyelitis* recurring rigors and sweats

due to septic infection are common In this latitude septic and pyæmic processes are too often confounded with *malaria*. In early tuberculosis, or even when signs of excavation are present in the lungs, and in cases of suppuration in various parts, particularly empyema and abscess of the liver, the diagnosis of malaria is made. The practitioner may take it as a safe rule, to which he will find very few exceptions, *that an intermittent fever which resists quinine is not malaria.*

Other conditions associated with chills which may be mistaken for pyæmia are profound anæmia, certain cases of Hodgkin's disease, the hepatic intermittent fever associated with the lodgment of gall-stone at the orifice of the common duct, rare cases of essential fever in nervous women, and the intermittent fever sometimes seen in rapidly developing cancer.

On two or three occasions I have met with intermittent pyrexia persisting for weeks, in which it seemed to be impossible to give any explanation of the phenomena—cases in which tuberculosis, malaria, or septicæmia could be almost positively excluded.

Treatment.—The treatment of septicæmia and pyæmia is largely a surgical problem. The cases which come under the notice of the physician usually have visceral abscesses or ulcerative endocarditis, conditions which are irremediable. We have no remedy which controls the fever. Quinine and the new antipyretics may be tried, but they are of little service. Quinine is probably better than antipyrin and antifebrin, which lower the temperature for a time, but when a careful two-hourly twenty-four-hour chart is taken, it is often found that the depression under the influence of the drug is made up at some other period of the day; a morning may be substituted for an afternoon fever.

The brilliant and remarkable results which follow complete evacuation of the pus with thorough drainage give the indication for the only successful treatment of this condition.

Unfortunately in too many cases which the physician is called upon to treat, the region of suppuration is not accessible, and we have to be content with the employment of general measures for the support of the patient's strength.

XVIII. CHOLERA ASIATICA.

Definition.—A specific, infectious disease, caused by the comma bacillus of Koch, and characterized clinically by violent purging and rapid collapse.

Historical Summary.—Cholera has been endemic in India from a remote period, but only within the present century has it made inroads into Europe and America. An extensive epidemic occurred in 1832, in which year it was brought in immigrant ships from Great Britain to Quebec. It

Dreschfeld has described these as idiopathic intermittent fever of pyæmic character (Med. Chronicle. April 1894 In three of his cases he describes there an enlargement of the liver & in two the condition was a diffuse suppurative hepatitis.

and again in 1892 and 1893

Koch found the comma bacilli in the water tanks in Indea, and also in the walls of ~~were~~ ~~have been~~ during the Hamburg epidemic of 1892.

during epidemics virulent bacilli may be found in the faeces of healthy persons.

travelled along the lines of traffic up the Great Lakes; and finally reached as far west as the military posts of the upper Mississippi. In the same year it entered the United States by way of New York. There were recurrences of the disease in 1835–'36. In 1848 it entered the country through New Orleans, and spread widely up the Mississippi Valley and across the continent to California. In 1849 it again appeared. In 1854 it was introduced by immigrant ships into New York and prevailed widely throughout the country. In 1866 and in 1867 there were less serious epidemics. In 1873 it again appeared in the United States, but did not prevail widely. In 1884 there was an outbreak in Europe. Although occasional cases have been brought by ship to the quarantine stations in this country, the disease has not gained a foothold here since 1873.

Etiology.—In 1884 Koch announced the discovery of the specific organism of this disease. Subsequent observations have confirmed his statement that the comma bacillus, as it is termed, occurs constantly in the true cholera, and in no other disease. It has the form of a slightly bent rod, which is thicker, but not more than about half the length of the tubercle bacillus, and sometimes occurs in an S-form. It is not a true bacillus, but really a spirochæte. The organism grows upon a great variety of media and displays distinctive and characteristic appearances. The bacilli are found in the intestine, in the stools from the earliest period of the disease, and very abundantly in the characteristic rice-water evacuations, in which they may be seen as an almost pure culture. They very rarely occur in the vomit. Post mortem, they are found in enormous numbers in the intestine. In acutely fatal cases they do not seem to invade the intestinal wall, but in cases with a more protracted course they are found in the follicles and even in the deeper tissues.

Modes of Infection.

(*a*) **Contagion.**—It appears probable that cholera is not highly contagious in the same sense as small-pox and scarlet fever, but in this respect is very similar to typhoid fever. Physicians, nurses, and others in close contact with the patients are not often affected. On the other hand, such persons as washer women, who are brought into very close contact with the cholera stools and the linen of the cholera patients, are particularly prone to the disease.

(*b*) **Infection.**—~~The leading authorities now agree that~~ the disease is propagated chiefly by the contamination of water used for drinking, washing, and cooking. ~~It is quite possible that~~ articles of food may be contaminated, particularly vegetables, such as lettuces and cresses and others, which have been washed in infected water; ~~but this is probably a minor danger in comparison with impure drinking-water.~~ ~~The bacilli~~, under ~~suitable circumstances~~—that is, when much impurity is present—may develop to some extent in the water; ~~Koch~~, as is well known, ~~found the bacilli in a tank in India, from which the inhabitants were supplied~~ with water for drinking and washing. Strongly in favor of this view is the fact

that the virulence of an epidemic in any region is generally in direct proportion to the imperfection of the water-supply. On the other hand, with improvements and perfection in the water-works of a place, the epidemics are reduced in intensity, and the place may even obtain immunity against the disease. Not only in India has the demonstration of the connection between drinking-water and cholera infection been amply furnished, but in England there have been many valuable illustrations. One of the most notable of these was the celebrated Broad Street pump, in London, which in 1854 was connected with a severe epidemic. Milk also may possibly in some instances convey the poison.

Pettenkofer, on the other hand, denies the truth of this drinking-water theory, and maintains that the conditions of the soil are of the greatest importance; particularly a certain porosity, combined with moisture and contamination with organic matter, such as sewage. According to him, the condition most favorable for the development of the virus is found when the subsoil water is lowest. As Stillé remarks: "It is more descriptive of the fact to say that so far as cholera has in any way to do with the condition of the soil, it is most apt to be severe and prevalent when very dry weather follows a very wet period. Such instances are most favorable to putrefactive fermentation and the dissemination of its products, which thus reach wells of drinking-water and even rivers, especially when sewers empty into the water."

Pettenkofer holds that germs develop in the subsoil moisture during the warm months, and that they rise into the atmosphere as a miasm.

The disease is always spread along the lines of human travel. In India it has, in many notable cases, been widely spread by pilgrims. It is carried also by caravans and in ships. It is not conveyed through the atmosphere.

Places situated at the sea-level are more prone to the disease than those situated inland. In high altitudes the disease does not prevail so extensively. A high temperature favors the development of the disease, but in Europe and America the epidemics have been chiefly in the late summer and in the autumn.

The disease attacks persons of all ages. It is particularly prone to attack the intemperate and those debilitated by want of food and bad surroundings. Depressing emotions, such as fear, undoubtedly have a marked influence. It is doubtful whether an attack furnishes immunity against a second one.

Morbid Anatomy.—There are no characteristic anatomical changes in cholera; but a post-mortem diagnosis of the nature of the disease could be made by any competent bacteriologist, as the micro-organisms are specific and distinctive. The body has the appearances associated with profound collapse. There is often marked post-mortem elevation of temperature. The *rigor mortis* sets in early and may produce displacement of the limbs. The lower jaw has been seen to move and the eyes to

Cholera asphyxia

and the latter of extensive coagulation necrosis
and destruction of the epithelial cells

rotate. Various movements of the arms and legs are also seen. The blood is thick and dark, and there is a remarkable diminution in the amount of water and salts. The peritonæum is sticky, and the coils of intestines are congested and look thin and shrunken. There is nothing special in the appearance of the stomach. The small intestine usually contains a turbid serum, similar in appearance to that which was passed in the stools. The mucosa is, as a rule, pale and swollen and often congested about the Peyer's patches. Post mortem the epithelial lining is sometimes denuded, but this is probably not a change which takes place during life. In the stools, however, large numbers of columnar epithelial cells have been described by many observers. The bacilli are found in the contents of the intestine and in the mucous membrane. The spleen is usually small. The liver and kidneys may show cloudy swelling. The heart is flabby; the right chambers are distended with blood and the left chambers are usually empty. The lungs are collapsed, and congested at the bases.

The above appearances are those met with in cases which prove rapidly fatal. When the patient survives and death occurs during reaction, there may be more definite inflammatory appearances in the intestines and more definite changes in the kidneys and liver.

Symptoms.—A period of incubation of uncertain length, probably not more than from two to five days, precedes the development of the symptoms.

Three stages may be recognized in the attack: the preliminary diarrhœa, the collapse stage, and the period of reaction.

(*a*) *The preliminary diarrhœa* may set in abruptly without any previous indications. More commonly there are, for one or two days, colicky pains in the abdomen, with looseness of the bowels, perhaps vomiting, with headache and depression of spirits. There may be no fever.

(*b*) *Collapse Stage.*—The diarrhœa increases, or, without any of the preliminary symptoms, sets in with the greatest intensity; and profuse liquid evacuations succeed each other rapidly. There are in some instances griping pains and tenesmus. More commonly there is a sense of exhaustion and collapse. The thirst becomes extreme, the tongue is white; cramps of great severity occur in the legs and feet. Within a few hours vomiting sets in and becomes incessant. The patient rapidly sinks into a condition of collapse, the features are shrunken, the skin of an ashy gray hue, the eyeballs sink in the sockets, the nose is pinched, the cheeks are hollow, the voice becomes husky, the extremities are cyanosed, and the skin is shrivelled, wrinkled, and covered with a clammy perspiration. The temperature sinks. In the axilla or in the mouth it may be from five to ten degrees below normal, but in the rectum and in the internal parts it may be 103° or 104°. The pulse becomes extremely feeble and flickering, and the patient gradually passes into a condition of coma, though consciousness is often retained until near the end.

The fæces are at first yellowish in color, from the bile pigment, but soon they become grayish white and look like turbid whey or rice-water; whence the term "rice-water stools." There are found in it numerous small flakes of mucus and granular matter, and at times blood. The reaction is usually alkaline. The fluid contains albumen and the chief mineral ingredient is chloride of sodium. Microscopically, mucus and epithelial cells and innumerable bacteria are seen, the majority of the latter being the comma bacilli.

The condition of the patient is largely the result of the concentration of the blood consequent upon the loss of serum in the stools. There is almost complete arrest of secretion, particularly of the saliva and the urine. On the other hand, the sweat-glands increase in activity, and in nursing women it has been stated that the lacteal flow is unaffected. This stage may not last more than two or three hours, but more commonly lasts from twelve to twenty-four. There are instances in which the patient dies before purging begins—the so-called *cholera sicca*.

(*c*) *Reaction Stage.*—When the patient survives the collapse, the cyanosis gradually disappears, the warmth returns to the skin, which may have for a time a mottled color or present a definite erythematous rash. The heart's action becomes stronger, the urine increases in quantity, the irritability of the stomach disappears, the stools are at longer intervals, and there is no abdominal pain. In the reaction the temperature may not rise above normal. Not infrequently this favorable reaction is interrupted by a recurrence of severe diarrhœa and the patient is carried off in a relapse. Other cases pass into the condition of what has been called *cholera-typhoid*, a state in which the patient is delirious, the pulse rapid and feeble, and the tongue dry. Death finally occurs with coma. These symptoms have been attributed to uræmia.

During epidemics attacks are found of all grades of severity. There are cases of diarrhœa with griping pains, liquid, copious stools, vomiting, and cramps, with slight collapse. The term *cholerine* has been applied to these cases. They resemble the milder cases of *cholera nostras*. At the opposite end of the series there are the instances of *cholera sicca*, in which death may occur in a few hours after the attack, without diarrhœa. There are cases also in which the patients are overwhelmed with the poison and die comatose, without the preliminary stage of collapse.

Complications and Sequelæ.—The typhoid condition has already been referred to. The consecutive nephritis rarely induces dropsy. Diphtheritic colitis has been described. There is a special tendency to diphtheritic inflammation of the mucous membranes, particularly of the throat and genitals. Pneumonia and pleurisy may develop, and destructive abscesses may occur in different parts. Suppurative parotitis is not very uncommon. In rare instances local gangrene may develop. A troublesome symptom of convalescence may be cramps in the muscles of the arms and legs.

2

And as an old truth says of the malignant form "It begins where others terminate — in death."

Diagnosis.—The only affection with which Asiatic cholera could be confounded is the *cholera nostras*, the severe choleraic diarrhœa which occurs during the summer months in temperate climates. The clinical picture of the two affections is identical. The extreme collapse, vomiting, and rice-water stools, the cramps, the cyanosed appearance, are all seen in the worst forms of cholera nostras. In enfeebled persons death may occur within twelve hours. It is of course extremely important to be able to diagnose between the two affections. This can only be done by one thoroughly versed in bacteriological methods, and conversant with the diversified flora of the intestines. The comma bacillus is present in the dejections of a great majority of the cases and can be seen on cover-glass preparations. Though the eye of the expert may be able to differentiate between the bacillus of true cholera and that which occurs in cholera nostras, cultures should be made, from which alone positive results can be obtained.

Attacks very similar to Asiatic cholera are produced in poisoning by arsenic, corrosive sublimate, and certain fungi; but a difficulty in diagnosis could scarcely arise.

The *prognosis* is always uncertain, as the mortality ranges in different epidemics from 30 to 80 per cent. Intemperance, debility, and old age are unfavorable conditions. The more rapidly the collapse sets in, the greater is the danger. Cases with marked cyanosis and very low temperature rarely recover.

Prophylaxis.—Preventive measures are all-important, and isolation of the sick and thorough disinfection have effectually prevented the disease entering England or the United States since 1873. On several occasions since that date, cholera has been brought to various ports in America, but has been checked at quarantine. During epidemics the greatest care should be exercised in the disinfection of the stools and linen of the patients. When an epidemic prevails, persons should be warned not to drink water unless previously boiled. Errors in diet should be avoided. As the disease is not more contagious than typhoid fever, the chance of a person passing safely through an epidemic depends very much upon how far he is able to carry out thoroughly prophylactic measures. Digestive disturbances are to be treated promptly, and particularly the diarrhœa, which so often is a preliminary symptom. For this opium and acetate of lead and large doses of bismuth should be given.

Attempts have been made to procure a protective virus. During the last epidemic in Europe, Ferran, in Spain, made a large number of inoculations which were claimed to be protective; but the French commission reported adversely against these claims. Shakespeare* seemed to have been more favorably impressed. Both Gamaleia and Lowenthal have ren-

* Report on Cholera in Europe and India. By E. O. Shakespeare, United States Commissioner. Washington, 1891.

dered animals immune against the cholera virus, but it is not probable that the method which they employ would be available for man.

Medicinal Treatment.—During the initial stage, when the diarrhœa is not excessive but the abdominal pain is marked, opium is the most efficient remedy, and it should be given hypodermically as morphia. It is advisable to give at once a full dose, which may be repeated on the return of the pain. It is best not to attempt to give remedies by the mouth, as they disturb the stomach. Ice should be given, and brandy or hot coffee. In the collapse stage, writers speak strongly against the use of opium. Undoubtedly it must be given with caution, but, judging from its effects in cholera nostras, I should say that collapse *per se* was not a contra-indication. For the intense thirst the patient may be given ice-water, of which he should be allowed to drink freely. The vomiting is very difficult to check. In severe cases creosote, hydrocyanic acid, and other remedies seem quite ineffectual.

Salol has been warmly recommended as capable of preventing the development of the bacilli in the intestine.

External applications of heat should be made and a hot bath may be tried. Warm applications to the abdomen are very grateful. Hypodermic injections of ether will be found serviceable.

Judging from the success which has followed the copious enemata in *cholera infantum*, this practice should be tried. Two or three pints of water should be allowed to flow slowly into the rectum. If the hips are elevated it may be retained for some time, but is usually rapidly ejected. The water may be given either cold or warm; probably the latter would be better. During the last epidemic in Italy, Cantani used this method, which he calls *enteroclysis*, with great success. In each injection he gave tannic acid and, generally, laudanum.

Owing to the profuse serous discharges the blood becomes concentrated, and absorption takes place rapidly from the lymph-spaces. This it is which gives the shrunken puckered appearance to the features and skin of a patient in the collapse stage. To meet this, intravenous injections have been practised. My preceptor, Bovell, first practised the intravenous injections of milk in Toronto, in the epidemic of 1854. Less risky and equally efficacious is the subcutaneous injection of a saline solution. For this common salt should be used in the proportion of about four grammes to the litre. With rubber tubing, a canula from an aspirator, or even with a hypodermic needle, the warm solution may be allowed to run by pressure beneath the skin. It is rapidly absorbed, and the process may be continued until the pulse shows some sign of improvement. This is really a valuable method, thoroughly physiological, and should be tried in all severe cases.

In the stage of reaction special pains should be taken to regulate the diet and to guard against recurrences of the severe diarrhœa.

or which
+ cocaine may be tried, and lavage with hot water.

and creolin have been found useless. Rumpf advises calomel (gr. 1/3rd) every two hours

Irrigation of the bowel, entero-clysis, with warm soap & water or tannic acid (2 per cent.) ~~gpt to the pint~~ should may be used. With a long soft rubber tube ~~should be used~~ as much as 3 or 4 litres may be slowly injected Not only is the colon cleansed but the small bowel may also be reached, ~~the~~ as shown by the fact that the tannic acid solutions have been vomited.

Two A litre of warm salt solution at 107° may be injected repeated in two hours and if no reaction follows

XIX. YELLOW FEVER.

Definition.—An acute febrile disease of tropical and subtropical countries, characterized by jaundice and hæmorrhages, and due to the action of a specific virus, the nature of which is yet unknown.

Etiology.—The disease prevails endemically in the West Indies and in certain sections of the Spanish Main. From these regions it occasionally extends and, under suitable conditions, prevails epidemically in the Southern States. Now and then it is brought to the large seaports of the Atlantic coast. Formerly it occurred extensively in the United States. In the latter part of the last century and the beginning of this, frightful epidemics prevailed in Philadelphia and other Northern cities. The epidemic of 1793, so graphically described by Matthew Carey, was the most serious that has ever prevailed in any city of the Middle States. The mortality, as given by Carey, during the months of August, September, October, and November, was 4,041, of whom 3,435 died in the months of September and October. The population of the city at the time was only 40,000. Epidemics occurred in the United States in 1797, 1798, 1799, and in 1802, when the disease prevailed slightly in Boston and extensively in Baltimore. In 1803 and 1805 it again appeared; then for many years the outbreaks were slight and localized. In 1853 the disease raged throughout the Southern States. In New Orleans alone there was a mortality of nearly eight thousand. In 1867 and 1873 there were moderately severe epidemics. In 1878 the last extensive epidemic occurred, chiefly in Louisiana, Alabama, and Mississippi. The total mortality was nearly sixteen thousand. In Europe it has occasionally gained a foothold, but there have been no wide-spread epidemics except in the Spanish ports. The disease exists on the west coast of Africa. It is sometimes carried to ports in Great Britain and France, but it has never extended into those countries. The history of the disease and its general symptomatology are exhaustively treated in the classical work of Réné La Roche.

Guitéras recognizes three areas of infection: (1) The focal zone in which the disease is never absent, including Havana, Vera Cruz, Rio, and other Spanish-American ports. (2) Perifocal zone or regions of periodic epidemics, including the ports of the tropical Atlantic in America and Africa. (3) The zone of accidental epidemics, between the parallels of 45° north and 35° south latitude.

The epidemics are invariably due to the introduction of the poison either by patients affected with the disease or through infected articles. Unquestionably the poison may be conveyed by fomites. Individuals of all ages and races are attacked. The negro is much less susceptible than the white, but he does not enjoy an immunity. Residents in southern countries, in which the disease is prevalent, are not so susceptible as strangers and temporary residents. Males are more frequently affected and the mortality is greater among them, owing probably to greater exposure.

Very young children usually escape; but in the epidemics of large cities the number under five attacked is large, since they constitute a considerable proportion of the population unprotected by previous attack. Guitéras states that the "foci of endemicity of yellow fever are essentially maintained by the creole infant population." Immunity is acquired by passing through an attack or by prolonged residence in a locality in which it is endemic. The statement so often made that the creoles are exempt from yellow fever has been abundantly disproved. They certainly are not so susceptible, but in severe epidemics they die in numbers. The evidence in favor of inherited immunity is not conclusive.

Conditions favoring the Development of Epidemics.—Yellow fever is a disease of the sea-coast, and rarely prevails in regions with an elevation above one thousand feet. Its ravages are most serious in cities, particularly when the sanitary conditions are unfavorable. It is always most severe in the badly drained, unhealthy portions of a city, where the population is crowded together in ill-ventilated, badly drained houses. The disease prevails during the hot season. In Havana the death-rate is greatest during the months of June, July, and August. The epidemics in the United States have always been in the summer and autumn months.

The specific germ of the disease has not yet been discovered. Sternberg, in his last report to the United States Government, concludes that the specific cause of yellow fever has not yet been demonstrated. With this statement Cornil and Babes* agree, and they do not accept the organisms described by Fréire, Carmona, and Gibier.

Morbid Anatomy.—The skin is more or less jaundiced. Cutaneous hæmorrhages may be present. No specific or distinctive internal lesions have been found. The blood-serum contains hæmoglobin, owing to destruction of the red cells, just as in pernicious malaria. The heart sometimes, not invariably, shows fatty change; the stomach presents more or less hyperæmia of the mucosa with catarrhal swelling. It contains the material which, ejected during life, is known as the *black vomit*. The essential ingredient in this is transformed blood-pigment. In the two specimens which I have had an opportunity of examining it differed in no respect from the material found in other affections associated with hæmatemesis. There is no proof that this black material depends upon the growth of a micro-organism. The liver is usually of a pale yellow or brownish-yellow color, and the cells are in various stages of fatty degeneration. From the date of Louis's observations at Gibraltar in 1828, the appearances of this organ have been very carefully studied, and some have thought the changes in it to be characteristic. Councilman has described remarkable appearances in the liver-cells which he believes are distinctive and peculiar. Fatty degeneration and regions of necrosis are present in all cases. The kidneys often show traces of diffuse nephritis. The epi-

* Les Bactéries, 1890.

thelium of the convoluted tubules is swollen and very granular; there may also be necrotic changes. In both liver and kidneys bacteria of various sorts have been described.

Symptoms.—The incubation is usually three or four days, but it may be less than twenty-four hours and prolonged to seven days. The onset is sudden; as a rule, without preliminary symptoms. An initial chill is common, and with it are usually associated headache and pains in the back and limbs. The fever rises rapidly and the skin feels very hot and dry. The face is flushed; the tongue furred, but moist; the throat sore. Nausea and vomiting are present, and become more intense on the second or third day. The bowels are usually constipated. The urine is reduced in amount and may be albuminous from the outset. The pulse, at first, has the usual febrile characters, but quickly becomes feeble and, as the jaundice develops, may become slow. This stage of invasion, or the *febrile stage*, lasts from a few hours to two or three days. It is succeeded by a remission, or, as it has sometimes been called, the *stage of calm*, during which the temperature falls and the severity of the symptoms abates. In favorable cases the fever now subsides and convalescence sets in. In such cases jaundice may not develop. In the third stage, or that of the *febrile reaction*, the temperature rises again and the symptoms become aggravated. The jaundice develops rapidly, the vomiting increases, and, in a considerable proportion of the cases, black vomit occurs. This consists of blood and gastric mucus altered by the acid juices of the stomach. Though usually regarded as distinctive and characteristic of the disease, material identical with it is brought up under other febrile conditions in which vomiting of blood occurs. Altered blood-corpuscles, epithelial cells, portions of food, and various fungi are found in the fluid. The vomiting may be accompanied by great abdominal pain. The stools are often tarry from the presence of altered blood. In mild cases the vomiting ceases during the first stage of the disease. Black vomit is not necessarily a fatal symptom, though it is present only in the severer cases of the disease. Jaundice occurs in a limited number of the cases which recover, and is present in almost all the fatal cases. From the character of the disease it is probably hæmatogenous in its origin. Bleeding may occur from the kidneys or from the gums, and hæmorrhages into the skin are not uncommon. As would be expected in a fever of this nature, the urine is albuminous; the amount varying a good deal with the intensity of the fever, and with the grade of jaundice. Febrile icterus, from whatever cause, is almost invariably associated with albuminuria and tube-casts, and the evidences of a diffuse nephritis.

Relapses occasionally occur. Among the varieties of the disease it is important to recognize the mild cases. These are characterized by slight fever, continuing for one or two days, and succeeded by a rapid convalescence. Such cases would not be recognized as yellow fever in the absence of a prevailing epidemic. Cases of greater severity have high fever and

the features of the disease are well marked—vomiting, prostration, and hæmorrhages. And lastly there are malignant cases in which the patient is overwhelmed by the intensity of the fever, and death takes place in two or three days.[1]

In severe cases convalescence may be complicated by the occurrence of parotitis, abscesses in various parts of the body, and diarrhœa. An attack confers an immunity which persists, as a rule, through life.

Diagnosis.—Mild cases, and even severe cases in the early period of an epidemic, are very difficult to recognize. The disease simulates closely, and may be mistaken for ordinary malarial remittent fever. It is not uncommon for physicians, in regions in which yellow fever is occasionally epidemic, to call the milder cases malarial fever, reserving the name of yellow fever for the severer forms with jaundice and black vomit. The only disease with which these cases could be confounded is malaria in its remittent and pernicious forms. But yellow fever can now be definitely and at once separated by the examination of the blood. Twice in Philadelphia I was sent for to determine whether a patient, freshly arrived in the city from the South, had yellow fever or pernicious malaria; and I was able in both instances, by finding Lavaran's organisms in the blood, to pronounce definitely upon the nature of the disease. The clinical picture in certain cases of malarial remittent and yellow fever may be almost identical. The presence of albumen in the urine, upon which some writers lay such stress as a distinguishing feature in yellow fever, is far too common a symptom in all forms of malaria to be worth much as a guide. Guitéras states that there may be difficulty for a time in recognizing the difference between mild cases of thermic fever and yellow fever.

Prognosis.—In its graver forms, yellow fever is one of the most fatal of epidemic diseases. The mortality has ranged, in various epidemics, from 15 to 85 per cent. In heavy drinkers and those who have been exposed to hardships the death-rate is much higher than among the better classes. In the epidemic of 1878, in New Orleans, while the mortality in hospitals was over 50 per cent of the white and 21 per cent of the colored patients, in private practice the mortality was not more than 10 per cent among the white patients. Favorable symptoms are a low grade of fever, slight jaundice, absence of hæmorrhages, and a free secretion of urine. If the temperature rises above 103° or 104° during the first two days, the outlook is serious. Black vomit is not an invariably fatal symptom. Cases with suppression of urine, delirium, coma, and convulsions rarely recover.

Prophylaxis.—The measures to be taken are—

(*a*) "Exclusion of the exotic germ of the disease by the sanitary supervision, at the port of departure, of ships sailing from infected ports, and thorough disinfection at the port of arrival, when there is evidence or reasonable suspicion that they are infected; (*b*) isolation of the sick on ship-

(1) For a full discussion of the morbid anatomy & Symptomatology of the disease the student is referred to the works of Joseph Jones of New Orleans & others & recent papers in the Journal of the American Medical Association, 1879

board, at quarantine stations, and, so far as practicable, in recently infected places; (*c*) disinfection of excreta, and of the clothing and bedding used by the sick, and of localities into which cases have been introduced, or which have become infected in any way; (*d*) depopulation of infected places—i. e., the removal of all susceptible persons whose presence is not necessary for the care of the sick" (Sternberg). During an epidemic, individuals who must remain in the locality should avoid the regions in which the disease prevails most; they should live temperately, avoiding all excesses, and should be careful not to get overheated, either in the sun or by exercise. It is very doubtful whether the preventive inoculations introduced by Fréire in Brazil and Carmona in Mexico are of any value.

Treatment.—Careful nursing and a symptomatic plan of treatment probably give the best results. Bleeding has long since been abandoned. How much patients will stand in this disease is illustrated by Rush's practice, which was of the most heroic character. He says: "From a newly arrived Englishman I took 144 ounces, at twelve bleedings, in six days; four were in twenty-four hours. I gave within the course of the same six days nearly 150 grains of calomel, with the usual proportions of jalap and gamboge"* With the courage of his convictions this modern Sangrado himself submitted to two bleedings in one day, and had his infant of six weeks old bled twice. Neither emetics nor purgatives are now employed. Of special remedies quinine is warmly recommended, and, when hæmorrhage sets in, the perchloride of iron. Digitalis, aconite, and jaborandi have been employed. Sternberg advises the following mixture: Bicarbonate of soda, 150 grains; bichloride of mercury, $\frac{1}{3}$ grain; pure water, 1 quart. Three tablespoonfuls to be given every hour. This is given on the view that the specific agent is in the intestine, and that its growth may possibly be restrained by this antacid and antiseptic mixture. The fever is best treated by hydrotherapy. There are several reports of the good effects of cold baths, sponging, and the application of ice-cold water to the head and the extremities in this disease. Vomiting is a very difficult symptom to control. Morphia hypodermically and ice in small quantities are probably the best remedies. Medicines given by the mouth for this purpose are said to be rarely efficacious.

We have no reliable medicine which can be depended upon to check the hæmorrhages. Ergot and acetate of lead and opium are recommended. The uræmic symptoms are best treated by the hot bath. Stimulants should be given freely during the second stage, when the heart's action becomes feeble and there is a tendency to collapse. The patient should be carefully fed; but when the vomiting is incessant it is best not to irritate the stomach, but to give nutritive enemata until the gastric irritation is allayed.

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* Manuscript letter to Redman Coxe.

XX. DYSENTERY.

Definition.—Under this clinical term several different forms of intestinal flux are described, which are characterized by frequent stools, and in the acute stage are accompanied by tormina and tenesmus. Anatomically there are inflammation and usually ulceration of the large bowel.

Etiology.—Dysentery is one of the four great epidemic diseases of the world. In the tropics it destroys more lives than cholera, and it has been more fatal to armies than powder and shot.

While especially severe in the tropics, sporadic cases constantly occur in more temperate climates, and under favoring circumstances epidemics are found even in the more northern countries, such as Canada and Norway. It has become less frequent of late years, owing to improved sanitary conditions. The statistics of the Montreal General Hospital, for the twenty years ending May 1, 1889, show a remarkable decrease in the disease. In the decade ending May, 1879, 150 cases were admitted; whereas in the last ten years there have been only 31 cases admitted. There has been a similar decrease at the Pennsylvania Hospital.

In the Southern cities of this country dysentery is more prevalent; even when not epidemic, sporadic cases are common. In Baltimore it prevails every summer, and has on several occasions been epidemic.

Epidemics of dysentery have occurred in the United States for more than a century, and Woodward has collected the data which show the various outbreaks. Perhaps the most serious was that which prevailed in various localities from 1847 to 1856. During the war of secession the disease existed to an alarming extent in both armies. According to Woodward's report,* there were in the Federal service in all 259,071 cases of acute and 28,451 cases of chronic dysentery. Probably a considerable proportion of the 182,586 cases of chronic diarrhœa should also come in this category. The decennial census reports since 1850 show a progressive decrease in the total number of deaths from this disease. It prevails most extensively in the summer and autumn. Sudden changes of temperature appear more harmful than variations in moisture. The effluvia from decomposing animal matter have been thought by some to predispose to or even to cause the disease. That dysenteric affections are more frequent in malarial localities has long been known, and is probably connected with external conditions favoring their development. With reference to the influence of drinking-water, Woodward is doubtless correct in stating that the effects of dissolved mineral matters have been greatly exaggerated. On the other hand, from the days of the old Greek physicians, it has been held that the impurities in the stagnant water of marshy districts and

* Medical and Surgical History of the War of the Rebellion, Medical, vol. ii; the most exhaustive treatise extant on intestinal fluxes—an enduring monument to the industry and ability of the author.

ponds may give rise to diarrhœa and dysentery. Here, however, it is probably not the vegetable impurities which are directly causative, but the organic matter renders the water a more favorable medium for the development of organisms which may cause disease.

Dyspeptic conditions, particularly those caused by the ingestion of bad food and unripe fruit, seem to predispose to the disease. Great stress has been laid by German authorities on the importance of constipation as a causal factor in dysentery.

Dysentery occurs at all ages. There is no race immunity. The contagiousness of the disease is doubtful. The experience of the civil war is decidedly against it, but the possibility, as with typhoid fever, must be acknowledged.

Clinical Forms.—(*a*) **Acute Catarrhal Dysentery.**—This may occur sporadically or endemically, and is the variety most frequently found in temperate climates.

Morbid Anatomy.—The lesions are confined to the large bowel, and sometimes the ileum also is involved. The mucous membrane is injected, swollen, and often covered with tenacious blood-stained mucus. The most striking feature is the enlargement of the solitary follicles, which stand out prominently from the mucous membrane. In very acute forms, as in children, the picture is that of an acute follicular colitis. In more protracted cases the follicles suppurate or are capped with an area of necrotic tissue. In other instances the sloughs have separated and the entire colon presents numerous ulcers, most of which have developed from the follicles, and others have resulted from necrosis and sloughing of the intervening tissue.

Symptoms.—There may be preliminary dyspepsia or slight pains in the abdomen. Chills are rare. Diarrhœa is the most constant initial symptom, and at first is not painful. Usually within thirty-six hours the characteristic features of the disease develop—abdominal pain of a colicky, griping character, frequent stools, which are passed with straining and tenesmus; the constitutional disturbance is variable, and in mild cases may be slight. The temperature range is not high, but at the outset the fever may rise to 102° or 103°. The tongue is furred and moist, and as the disease progresses becomes red and glazed. Nausea and vomiting may be present, but as a rule the patient retains nourishment. The constant desire to go to stool and the straining or tenesmus are the most distressing symptoms. The abdomen may be flat and hard. The thirst is often excessive. The stools in this variety of dysentery have the following characters: During the first twenty-four or forty-eight hours they consist of more or less clear mucus and blood mixed with small fæcal scybala. After this they become purely gelatinous and bloody, and are small and frequent, from fifteen to two hundred in twenty-four hours, according to the severity of the case. About the end of the first week the mucus becomes opaque, the proportion of blood diminishes, and grayish or brownish shreddy material

appears in the stools, which become gradually reduced in frequency. Some of the stools at this time may be wholly composed of a greenish pultaceous material and mucus. As the disease subsides, fæcal matter again appears in the stools, increasing in amount until fully formed fæces are passed, containing no mucus or blood. Microscopical examination of the glairy bloody stools shows red blood-corpuscles, few or many leucocytes, and constantly large, swollen, round or oval epithelioid cells, containing fat-drops and vacuoles. Bacteria are scarce; occasionally the *cercomonas intestinalis* is seen in large numbers.

Course of the Disease.—The milder cases run a course, as Flint has shown, of about eight days; severer ones rarely terminate within four weeks. Recovery may be imperfect, and the affection occasionally becomes chronic. In this form the complications are not numerous; peritonitis and liver abscess are extremely rare. Except in young children, a majority of the cases terminate favorably.

(*b*) **Tropical Dysentery—Amœbic Dysentery.**—This form of intestinal flux is characterized by irregular diarrhœa and the constant presence in the stools of the *amœba coli* (Lösch), *amœba dysenteriæ* (Councilman and Lafleur). It is this variety which prevails extensively in the tropical and subtropical regions, and which proves so fatal in epidemic form. The amœba is a unicellular, protoplasmic, motile organism, from ten to twenty micromillimetres in diameter, consisting of a clear outer zone, ectosarc, and a granular inner zone, endosarc, containing a nucleus and one or more vacuoles. It was first described by Lambl in 1859, and subsequently by Lösch, who considered it the cause of the disease. In the endemic dysentery of Egypt, Kartulis, in 1883, found these amœbæ constantly in the stools, in the intestines, and in the liver abscesses. He was afterward enabled to cultivate them in straw infusion, and to produce the disease artificially in cats and dogs. In 1890 I reported a case of dysentery with abscess of the liver originating in Panama, in which the amœbæ were found in the stools and in the pus from the abscess; and lately Councilman and Lafleur* have described the clinical features and anatomical lesions in a series of cases of this form of dysentery in my wards. Dock, in Galveston, has demonstrated their presence in a number of cases, and Musser has found them in Philadelphia. The disease is very common in tropical and subtropical countries. It is, however, found more or less widely distributed throughout Europe and North America. The sources of infection are not known, but it seems probable that one of them is drinking-water.

Morbid Anatomy.—The lesions are found in the large intestine, sometimes in the lower portion of the ileum. Abscess of the liver is a common sequence. Perforation into the right lung is not infrequent.

Intestines.—The lesions consist of ulceration, produced by preceding

* Johns Hopkins Hospital Reports, vol. ii.

P.

Casper - Dock says fifteen to thirty

Non-pathogenic Amœbæ are occasionally found in the stools of healthy men. Quincke & Roos recognize three forms of parasitic amœbæ, two of which are pathogenic.

infiltration, general or local, of the submucosa, the general infiltration being due to an œdematous condition, the local to multiplication of the fixed cells of the tissue. In the earliest stage these local infiltrations appear as hemispherical elevations above the general level of the mucosa. The mucous membrane over these soon becomes necrotic and is cast off, exposing the infiltrated submucous tissue as a grayish-yellow gelatinous mass, which at first forms the floor of the ulcer, but is subsequently cast off as a slough.

The individual ulcers are round, oval, or irregular, with infiltrated, undermined edges. The visible aperture is often small compared to the loss of tissue beneath it, the ulcers undermining the mucosa, coalescing, and forming sinuous tracts bridged over by apparently normal mucous membrane. According to the stage at which the lesions are observed, the floor of the ulcer may be formed by the submucous, the muscular, or the serous coat of the intestine. The ulceration may affect the whole or some portion only of the large intestine, particularly the cæcum, the hepatic and sigmoid flexures, and the rectum. In severe cases the whole of the intestine is much thickened and riddled with ulcers, with only here and there islands of intact mucous membrane.

The disease advances by progressive infiltration of the connective-tissue layers of the intestine, which produces necrosis of the overlying structures. Thus, in severe cases there may be in different parts of the bowel sloughing *en masse* of the mucosa or of the muscularis, and the same process is observed, but not so conspicuously, in the less severe forms.

In some cases a secondary diphtheritic inflammation complicates the original lesions.

Healing takes place by the gradual formation of fibrous tissue in the floor and at the edges of the ulcers, which may ultimately result in partial and irregular strictures of the bowel.

Microscopical examination shows a notable absence of the products of purulent inflammation. In the infiltrated tissues polynuclear leucocytes are seldom found, and never constitute purulent collections. On the other hand, there is proliferation of the fixed connective-tissue cells. Amœbæ are found more or less abundantly in the tissues at the base of and around the ulcers, in the lymphatic spaces, and occasionally in the blood-vessels.

The lesions in the *liver* are of two kinds: firstly, local necroses of the parenchyma, scattered throughout the liver and possibly due to the action of chemical products of the amœbæ; and, secondly, abscesses. These may be single or multiple. When single they are generally in the right lobe, either toward the convex surface near its diaphragmatic attachment, or on the concave surface in proximity to the bowel. Multiple abscesses are small and generally superficial. In an early stage the abscesses are grayish-yellow, with sharply defined contours, and contain a spongy necrotic material, with more or less fluid in its interstices. The larger abscesses have

ragged necrotic walls, and contain a more or less viscid, greenish-yellow or reddish-yellow purulent material mixed with blood and shreds of liver-tissue. The older abscesses have fibrous walls of a dense, almost cartilaginous toughness. A section of the abscess wall shows an inner necrotic zone, a middle zone in which there is great proliferation of the connective-tissue cells and compression and atrophy of the liver-cells, and an outer zone of intense hyperæmia. There is the same absence of purulent inflammation as in the intestine, except in those cases in which a secondary infection with pyogenic organisms has taken place. The material from the abscess cavity shows chiefly fatty and granular detritus, few cellular elements, and more or less numerous amœbæ. Amœbæ are also found in the abscess walls, chiefly in the inner necrotic zone. Cultures are usually sterile. Lesions in the lungs are seen when an abscess of the liver—as so frequently happens—points toward the diaphragm and extends by continuity through it into the lower lobe of the right lung. The gross and microscopical appearances are similar to those of the liver.

Symptoms.—The onset may be sudden, as in catarrhal dysentery, or gradual, beginning as a trifling and perhaps transient diarrhœa. In severe gangrenous cases the abrupt onset is more common. The subsequent course is a very irregular diarrhœa, marked by exacerbations and intermissions, and progressive loss of strength and flesh. There is moderate fever as a rule, but many cases are afebrile throughout the greater part of their course. Abdominal pain and tenesmus are frequently present at the onset, especially in severe cases, but may be entirely absent, and vomiting and nausea are only occasionally observed. The stools vary very much in frequency and appearance in different cases and at different periods in the same cases. They may be very frequent, bloody, and mucoid at the outset, as in catarrhal dysentery; but their main characteristic, when the disease is well established, is fluidity. From six to twelve yellowish-gray liquid stools, containing mucus and occasionally blood in varying proportions, are passed daily for weeks. Actively moving amœbæ are found in these stools, more abundantly during exacerbations of the diarrhœa, and disappear gradually as the stools become formed.

Abscess of the liver, and especially of the liver and lung, is a frequent and formidable complication. In India it occurs once in every four or five cases.

The duration of the disease in uncomplicated cases varies from six to twelve weeks. Recovery is tedious, owing to anæmia and muscular weakness, often delayed by relapses, and there is in all cases a constant tendency to chronicity. The mortality is much higher than in catarrhal dysentery. A fatal issue is due either to the initial gravity of the intestinal lesions, to exhaustion in prolonged cases, or to involvement of the liver.

(*c*) **Diphtheritic Dysentery.**—A form of colitis or entero-colitis in which areas of necrosis occur in the mucous membranes, which on sepa-

ration leave ulcers. This occurs: (*a*) As a *primary* disease coming on acutely and sometimes proving fatal. In its milder grades the tops of the folds of the colon are capped with a thin, yellow exudate. In severer forms the colon is enormously enlarged, the walls are thickened, stiff, and infiltrated, and the mucosa, from the ileo-cæcal valve to the rectum, represented by a tough, yellowish material, in which on section no trace of the glandular elements can be seen. It is an extensive necrosis of the mucosa. There are cases in which this necrosis is superficial, involving only the upper layers of the mucous membrane; but in the most advanced forms it may be, as in the description by Rokitansky, "a black, rotten, friable, charred mass." The areas of necrosis may be more localized, and large sloughs are formed which may be a half to three fourths of an inch in thickness and extend to the serosa. There are instances in which this condition is confined to the lower portion of the large bowel. A sailor from the Mediterranean was admitted to the Montreal General Hospital under my care with symptoms resembling typhoid fever. The autopsy showed enormous sloughs in the rectum and in the sigmoid flexure, but scarcely any disease in the transverse or ascending colon. In cases which last for many weeks the sloughs separate and may be thrown off, sometimes in large tubular pieces.

(*b*) *Secondary Diphtheritic Dysentery.*—This occurs as a terminal event in many acute and chronic diseases. It is not infrequent in chronic heart affections, in Bright's disease, and in cachectic states generally. In acute diseases it is, as pointed out by Bristowe, most frequently associated with pneumonia. Anatomically there may be only a thin, superficial infiltration of the upper layer of the mucosa in localized regions, particularly along the ridges and folds of the colon, often extending into the ileum. In severer forms the entire mucosa may be involved and necrotic, sometimes having a rough, granular appearance. In the secondary colitis of pneumonia the exudation may be pseudo-membranous and form a firm, thin, white pellicle which seems to lie upon, not within, the mucous membrane.

Symptoms.—The clinical features of diphtheritic dysentery are very varied. In the acute *primary* cases the patient from the outset is often extremely ill, with high fever, great prostration, pain in the abdomen, and frequent discharges. Delirium may be early and the clinical features may closely resemble severe typhoid. I have, on more than one occasion, known this mistake to be made. The abdomen is distended and often tender. The discharges are frequent and diarrhœal in character, and tenesmus may not be a striking symptom. Blood and mucus may be found early, but are not such constant features as in the follicular disease. This primary form is very fatal, but the sloughs may separate and the condition become chronic. In the *secondary* form there may have been no symptoms to attract attention to the large bowel. In a majority of the cases the patient has a diarrhœa—three, four, or more movements in the

day, which are often profuse and weakening. A little blood and mucus may be passed at first, but they are not specially characteristic elements in the stools.

In all forms of dysentery death usually results from asthenia. The pulse becomes weaker and more rapid, the tongue dry, the face pinched, the skin cool and covered with sweat, and the patient falls into a drowsy, torpid condition. Consciousness may be retained until the last, but in the protracted cases there is a low delirium deepening into collapse.

(*d*) **Chronic Dysentery.**—This usually succeeds an acute attack, though the amœbic form may be subacute from the outset and not present an acute period. Anatomical changes in the large intestine in chronic dysentery are variable. There may be no ulceration, and the entire mucosa presents a rough, irregular puckered appearance, in places slate-gray or blackish in color. The submucosa is thickened and the muscular coats are hypertrophied. There may be cystic degeneration of the glandular elements, as is beautifully figured in Woodward's volume.

Ulcers are usually present, often extensive and deeply pigmented, in places perhaps healing. The submucous and muscular coats are thickened and the calibre of the bowel may be reduced. Stricture, however, is very rare.

The *symptoms* of chronic dysentery are by no means definite, and it is not always possible to separate the cases from those of chronic diarrhœa. Many of the characteristic symptoms of the acute disease are absent. Tenesmus and severe griping pains rarely occur except in acute exacerbations. The character of the stools varies very much. Blood and necrotic shreddy tissue are not often found. Mucus is passed in variable amounts. On a mixed diet the fæces are thin, often frothy, and contain particles of food. The motions vary from four or five to twelve or more in the twenty-four hours. There are cases in which marked constipation alternates with attacks of diarrhœa, and scybala may be passed with much mucus. In many cases the fæces have a semi-fluid consistency, and a yellowish or brown color depending on the amount of bile. Fragments of undigested food may be found, and the discharges have the character of what is termed a lienteric diarrhœa. Indeed, variations in the bile and in the food give at once corresponding variations in the character of the stools. In chronic dysentery recurrences are common in which blood and mucus again appear in the stools, accompanied perhaps by pus. Flatulence is in some cases distressing, and there is always more or less tenderness along the course of the colon. The appetite is capricious, the digestion disordered, and unless the patient is on a strictly regulated diet the number of stools is greatly increased. The tongue is not often furred; it is more commonly red, glazed, and beefy, and becomes dry and cracked toward the end in protracted cases. There is always anæmia and the emaciation may be extreme; with the exception of gastric cancer, we rarely see such ghastly faces as in patients with prolonged dysentery.

Malaria & dysentery are frequently
occur together; the former yields readily to
quinine

The complications are those already referred to in the acute form. The greater debility renders the patient more liable to the intercurrent affections, such as pneumonia and tuberculosis. Ulceration of the cornea was frequently noted during the civil war.

Complications and Sequelæ.—A local peritonitis may arise by extension, or a diffuse inflammation may follow perforation, which is usually fatal. When this occurs about the cæcal region, perityphlitis results; when low down in the rectum, periproctitis. In one hundred and eight autopsies collected by Woodward perforation occurred in eleven. By far the most serious complication is abscess of the liver, which occurs frequently in the tropics and is not very uncommon in this country. It was not, however, a frequent complication in dysentery during the civil war. In this latitude it is certainly not uncommon, as we have had five cases, within two years, in the Johns Hopkins Hospital. It usually comes on insidiously. The symptoms will be discussed in connection with hepatic abscess.

It is stated that malaria is a complication, but with one exception the cases which I have seen with intermittent pyrexia were invariably associated with suppuration. In extensive epidemics, however, Woodward states that cases of ordinary dysentery occur associated with all the phenomena of malaria. With reference to typhoid fever, as a complication, this author mentions that the combination was exceedingly frequent during the civil war, and characteristic lesions of both diseases coexisted. In civil practice it must be extremely rare

Sydenham noted that dysentery was sometimes associated with rheumatic pains, and in certain epidemics joint swellings have been especially prevalent. They are probably not of the nature of true rheumatism, but are rather analogous to gonorrhœal arthritis. In severe, protracted cases there may be pleurisy, pericarditis, endocarditis, and occasionally pyæmic manifestations, among which may be mentioned pylephlebitis. Chronic Bright's disease is also an occasional sequel. In protracted cases there may be an anæmic œdema. An interesting sequel of dysentery is paralysis. Woodward reports eight cases. Weir Mitchell mentions it as not uncommon, occurring chiefly in the form of paraplegia. As in other acute fevers, this is due to a neuritis.* Intestinal stricture is a rare sequence—so rare that no case was reported at the Surgeon-General's office during the war. Among the sequelæ of chronic dysentery, in persons who have recovered a certain measure of health, may be mentioned persistent dyspepsia and irritability of the bowels.

Diagnosis.—The recognition of the acute follicular form is easy; the frequency of the passages, the presence of blood and mucus, and the tenesmus forming a very characteristic picture. Local affections of the rectum, particularly syphilis and epithelioma, may produce tenesmus with

* Pugibet, Revue de Médecine, February, 1888.

the passage of mucoid and bloody stools. The acute diphtheritic form, coming on with great intensity and with severe constitutional disturbances, is not infrequently mistaken for typhoid fever, to which indeed in many cases the resemblance is extremely close. The higher grade of fever, the more pronounced intestinal symptoms, the presence, particularly in the early stage, of a small amount of blood in the stools, the absence of enlargement of the spleen and the rose rash should lead to a correct diagnosis. In the amœbic form the diagnosis can readily be made by examination of the stools. A characteristic feature of these cases is their irregular, chronic course. A patient may be about and in fairly good condition, with well-formed stools and very slight intestinal disturbance, in whose fæces the amœbæ may still be discovered, and in whom the disease is at any time likely to recur with intensity. In some cases, complicated by abscess of the liver and lung discharging through a bronchus, the diagnosis may rest on the detection of amœbæ in the sputa, when they cannot be found in the stools owing to the latency of the intestinal disturbance. Three such cases occurred in my wards in 1890.*

Treatment.—Flint has shown that sporadic dysentery is, in its slighter grades at least, a self-limited disease, which runs its course in eight or nine days. Reading a report of his cases, one is struck, however, with their comparative mildness.

The enormous surface involved, amounting to many square feet, the constant presence of irritating particles of food, and the impossibility of getting absolute rest, are conditions which render the treatment of dysentery peculiarly difficult. Moreover, in the severer cases, when necrosis of the mucosa has occurred, ulceration necessarily follows, and cannot in any way be obviated. When a case is seen early, particularly if there has been constipation, a saline purge should be given. The free watery evacuations produced by a dose of salts cleanse the large bowel with the least possible irritation, and if necessary, in the course of the disease, particularly if scybala are present, the dose may be repeated. Purgatives are, as a rule, objectionable, and the profession has largely given up their use. Of medicines given by the mouth which are supposed to have a direct effect upon the disease, ipecacuanha still maintains its reputation in the tropics. It did not, however, prove satisfactory during the civil war; nor can I say that in cases of sporadic dysentery I have ever seen the marked effect described by the Anglo-Indian surgeons. The usual method of administration is to give a preliminary dose of opium, in the form of laudanum or morphia, and half an hour after from twenty to sixty grains of ipecacuanha. If rejected by vomiting, the dose is repeated in a few hours.

Minute doses of corrosive sublimate, one hundredth of a grain every two hours, are warmly recommended by Ringer. Large doses of bismuth, half a drachm to a drachm every two hours, so that the patient may take

* For details see monograph of Councilman and Lafleur.

from twelve to fifteen drachms in a day, have in many cases had a beneficial effect. To do good it must be given in large doses, as recommended by Monneret, who gave as high as seventy grammes a day. It certainly is more useful in the chronic than the acute cases. It is best given alone. Opium is an invaluable remedy for the relief of the pain and to quiet the peristalsis. It should be given as morphia, hypodermically, according to the needs of the case.

The treatment of dysentery by topical applications is by far the most rational plan. A serious obstacle, however, in the acute cases, is the extreme irritability of the rectum and the tenesmus which follows any attempt to irrigate the colon. A preliminary cocaine suppository or the injection of a small quantity of the four-per-cent solution will sometimes relieve this, and then with a long tube the solution can be allowed to flow in slowly. The patient should be in the dorsal position with a pillow under the hips, so as to get the effect of gravitation. Water at the temperature of 100° is very soothing, but the irritability of the bowel is such that large quantities can rarely be retained for any time. When the acute symptoms subside, the injections are better borne. Various astringents may be used—alum, acetate of lead, sulphate of zinc and copper, and nitrate of silver. Of these remedies the nitrate of silver is the best, though I think not in very acute cases. In the chronic form it is perhaps the most satisfactory method of treatment which we have. It is useless to give it in the small injections of two or three ounces with one to two grains of the salt to the ounce. It must be a large irrigating injection, which will reach all parts of the colon. This plan was introduced by Hare, of Edinburgh, and is highly recommended by Stephen Mackenzie and H. C. Wood. The solution must be fairly strong, twenty to thirty grains to the pint, and if possible from three to six pints of fluid must be injected. To begin with it is well to use not more than a drachm to the two pints or two and a half pints, and to let the warm fluid run in slowly through a tube passed far into the bowel. It is at times intensely painful and is rejected at once. In the cases of amœbic dysentery we have been using at the Johns Hopkins Hospital with great benefit warm injections of quinine in strength of 1 to 5,000, 1 to 2,500, and 1 to 1,000. The amœbæ are rapidly destroyed by it. These large injections are not without a certain degree of danger. Brayton Ball reports the case of a child in whom general peritonitis followed the injections. I have never seen any ill effects, even with the very large amounts. When there is not much tenesmus, a small injection of thin starch with half a drachm to a drachm of laudanum gives great relief, but for the tormina and tenesmus, the two most distressing symptoms, a hypodermic of morphia is the only satisfactory remedy. Local applications to the abdomen, in the form of light poultices or turpentine stupes, are very grateful.

The diet in acute cases must be restricted to milk, whey, and broths,

and during convalescence the greatest care must be taken to provide only the most digestible articles of food. In chronic dysentery, diet is perhaps the most important element in the treatment. The number of stools can frequently be reduced from ten or twelve in the day to two or three, by placing the patient in bed and restricting the diet. Many cases do well on milk alone, but the stools should be carefully watched and the amount limited to that which can be digested. If curds appear, or if much oily matter is seen on microscopical examination, it is best to reduce the amount of milk and to supplement it with beef-juice or, better still, egg-albumen The large doses of bismuth seem specially suitable in the chronic cases, and the injections of nitrate of silver, in the way already mentioned, should always be given a trial.

XXI. MALARIAL FEVER.

Definition.—An infectious disease characterized by: (*a*) paroxysms of intermittent fever of quotidian, tertian, or quartan type; (*b*) a continued fever with marked remissions; (*c*) certain pernicious, rapidly fatal forms; and (*d*) a chronic cachexia, with anæmia and an enlarged spleen.

With the disease are invariably associated the hæmatozoa described by Laveran.

Etiology.—(1) **Geographical Distribution.**—In Europe, southern Russia and certain parts of Italy are now the chief seats of the disease. It is not widely prevalent in Germany, France, or England, and the foci of epidemics are becoming yearly more restricted. In America it is now rare on the Atlantic coast above the latitude of Philadelphia. From New England, where it once prevailed extensively, it has gradually disappeared, but there has of late years been a slight return in some places. In the city of New York genuine malaria is rare except as an imported disease. In Philadelphia and along the valleys of the Delaware and Schuylkill Rivers, formerly hot-beds of malaria, the disease has become much restricted. Except in the low-lying southern portions of the city it rarely develops, and the majority of cases admitted into hospital are of the poorer class, who have returned from picking cranberries and peaches in Delaware and New Jersey. In Baltimore a few cases develop in the autumn, but a majority of the patients seeking relief are from the outlying districts and one or two of the inlets of Chesapeake Bay. Though prevalent in certain regions on this bay, the disease is yearly becoming less widespread and less severe. In the Southern States there are on the seaboard many isolated regions in which malaria prevails; but here, too, there has everywhere been a marked diminution in the prevalence and intensity of the disease. W. W. Johnston states that in the Gulf district there are places in which the disease is increasing. The percentage of cases admitted to the Marine Hospital Service in 1876 was 18·4, and 23·4 in 1887.

But this may be due to the development of the shipping trade and to the greater number of sailors who carry the infection from the West Indian ports, and those of Mexico and Central America.

In the interior of Louisiana, Mississippi, Arkansas, and Texas malaria is endemic, and the severe types are not infrequent. At irregular periods epidemics of the most severe forms occur.

In the ~~Western and~~ Northwestern States malaria is almost unknown. It is rare on the Pacific coast. In the region of the Great Lakes malaria prevails only in the Lake Erie and Lake St. Clair regions. It has practically disappeared from Lake Ontario, whereas in the upper Huron and Lake Superior basins it is unknown. The St. Lawrence River region remains free from the disease. In Montreal a patient with malaria is invariably questioned as to his latest residence.

(2) **Telluric Conditions.**—The importance of the state of the soil in the etiology of malaria is universally recognized. It is seen particularly in low, marshy regions which have an abundant vegetable growth. Estuaries, badly drained, low-lying districts, the course of old river-beds, tracts of land which are rich in vegetable matter, and particularly districts such as the Roman Campagna, which have been allowed to fall out of cultivation, are favorite localities for the development of the malarial poison. These conditions are most frequently found, of course, in tropical and subtropical regions, but nothing can be truer than the fact that reeking marshes of the most pestilent appearance may be entirely devoid of the poison, and the disappearance of the disease from a locality is not necessarily associated with any material improvement in the condition of the marshes or of the soil. Thus, in New England and in parts of western Canada, in which malaria formerly was very prevalent, the increased salubrity is usually attributed to the clearing of the forests and the better drainage of the ground; but these improvements alone can scarcely explain the disappearance, since in many districts there are marshy tracts and low-lying lands in every respect like those in which, even at the same latitude, the disease still prevails. Compare, for example, a swampy tract on the northern shore of Lake Erie and a similar tract on the southern shore of Lake Ontario; the flora and fauna of the two districts are practically identical, but in the former the conditions under which the malarial virus develops still exist, whereas in the latter they have gradually disappeared. In short, it is impossible to ascertain from the nature of the soil and climate in any given place whether it is malarial or not. In the absence of accurate knowledge as to the habitat of the hæmatozoa, the only means of deciding this point is by noticing the effect of residence in such a place on the human subject, preferably one of the Caucasian race.

(3) **Season.**—Even in the tropics, where malaria constantly prevails, there are minimal and maximal periods; the former corresponding to the summer and winter, the latter to the spring and autumn months. In temperate regions, like the central Atlantic States, there are only a few

cases in the spring, usually in the month of May, and a large number of cases in September and October, and sometimes in November. In the tropics, too, the cases are most numerous in the autumn months.

(4) **Meteorological Conditions.**—(*a*) *Heat.*—A tolerably high temperature is one of the essential conditions for the development of the virus. It is more prevalent after prolonged hot summers.

(*b*) *Moisture.*—In the tropics the malarial fevers are most prevalent in the rainy seasons. In the temperate climates the relation between the rainfall and malaria is not so clear, and cases are more numerous after a dry summer; but if either heat or moisture is excessive, the development of the virus is checked for a time.

(*c*) *Winds.*—Many facts are on record which seem to indicate that the poison may be carried to some distance by winds. The planting of trees has been held to interfere with the transmission by prevailing winds. Possibly, however, the quickly growing trees, such as the *Eucalyptus globulus*, have acted more beneficially by drying the soil.

(5) **Specific Gravity.**—That the distribution of the poison of malaria is influenced by gravity has long been conceded. Persons dwelling in the upper stories, or in buildings elevated some distance above the ground, are exempt in a marked degree.

The Specific Germ.—As Hirsch correctly remarks, the late J. K. Mitchell "was the first to approach in a scientific spirit the nature of infective disease and particularly in malarial fever." Many attempts were made to discover a constant and characteristic organism. Klebs and Tommasi-Crudeli in 1879 announced the discovery of a *bacillus malariæ*, but their observations have not been confirmed. In 1880 Laveran, a French army surgeon, now professor at the Medical School at Val de Grace, announced the discovery of a parasite in the blood of patients attacked by malarial fever. During the next three years he published nine additional communications, but for a time these observations attracted little attention. The Italian observers Marchiafava, Celli, and Golgi corroborated Laveran's statements. Councilman carefully studied the question in this country, and Laveran's statements were confirmed by myself in Philadelphia, by Walter James in New York, and more recently by Dock in Galveston. In India, Vandyke Carter has published an elaborate monograph on the parasites. In France, Germany, and England, owing in great part to the absence of cases of malaria, the value of Laveran's observations has been overlooked, but recently the confirmation has been published from many of the German clinics. So far as I know, not a single observer, who has had the necessary training and the material at his command, has failed to demonstrate the existence of these parasites.

The bodies which have been found invariably associated with all forms of malarial fevers, belong to the protozoa and to a group of organisms known as the *hæmatozoa*, the precise affinities of which have not yet been definitely determined. In some respects they closely resemble the monads,

in others the sporozoa. Parasites of the red blood-corpuscles have been met with abundantly in the blood of fish, turtles, and many species of birds. One of the best and most readily studied examples is the *Drepanidium ranarum*, a common parasite in the red blood-corpuscles of the frog.* In the blood of patients with malarial fevers the following forms may be seen: (1) an unpigmented hyaline body within the red blood-corpuscles which displays active movements; (2) a pigmented amœboid body within the red blood-corpuscles, which, under certain circumstances, may increase in size and form (3) a segmenting body, in which the protoplasm divides into a variable number of definite small spheres; (4) crescentic bodies, the so-called *crescents*, which develop within the blood-corpuscles and form characteristic and distinctive structures; (5) flagellate organisms, which may be seen to develop from the intercellular pigmented forms, or from ovoid bodies which are altered crescents; (6) free flagella. To the amœboid from within the red blood-corpuscles Marchiafava and Celli gave the name *plasmodium malariæ*. The following statements may be made with reference to these bodies:

The highest living authorities on protozoa, such as Bütschli, of Heidelberg, acknowledge that they are truly parasitic organisms. The testimony is now unanimous in France, India, America, Italy, and Germany that these bodies are always present in the malarial fevers. There is no evidence to show that they are ever present in any other disease. I can speak on this point with some confidence, having for years been in the habit of making blood examinations.

The relation of the parasites to the symptoms of the disease has been worked out in part by Golgi, who has shown that corresponding to the paroxysm there is a process of segmentation.

The relation of the different phases of growth to the varieties of malarial fever has not yet been thoroughly established, but the following points may be referred to: The typical intermittents are associated with large forms of the parasites, of which several varieties have been described. Golgi has described two distinct forms which he considers the causes of tertian and quartan fevers, and makes all other types depend on combinations of these. This probably holds good for a large proportion of intermittents. With the remittents, Marchiafava and Celli have described a distinct species, and look upon the crescents as representing a phase in its development. The pernicious malarial fevers are also associated with this variety, which the Italian observers call the "small plasmodium." The crescents may occur also in acute cases, but are most constant in malarial cachexia. The flagellate bodies do not appear to have any definite relation to the different forms of the disease.

The general symptoms and the morbid anatomy of malaria are in har-

* For an excellent account of these hæmatozoa and their development, see Celli, in Fortschritte der Medicin, 1891.

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The general symptoms and the morbid anatomy of malaria are in har-

* For an excellent account of these hæmatozoa and their development, see *Celli*, in Fortschritte der Medicin, 1891.

mony with the changes which this parasite induces. The destruction of the red blood-corpuscles by it can be traced in all stages. The presence of the pigment in the blood and the viscera, so characteristic of malaria, results from the transformation of the hæmoglobin by the plasmodia. The anæmia is a direct consequence of the wide-spread destruction of the corpuscles by the parasites. The constancy of their presence, the fact of their causing rapid destruction of the red blood-corpuscles, and the remarkable coincidence of their disappearance contemporaneously with the symptoms on the administration of quinine, are points strongly in favor of their etiological relation with the disease. There are still many gaps in our knowledge. We do not know how the parasite enters, or how or in what form it leaves the body; how and where it is propagated; under what outside conditions it develops, whether free or in some aquatic plant or animal. No record of its successful cultivation has been published.

Meantime, awaiting further knowledge, advantage may be taken of its constant presence in malaria. This alone, without reference to the true nature of the organism, is a fact of the highest importance. To be able, everywhere and under all circumstances, to differentiate between malaria and other forms of fever is one of the most important advances which has been made of late years in practical medicine, one which will revolutionize the study of fevers in tropical and subtropical countries, and should, within a short time, bring some order out of the chaos which at present exists regarding the different forms which there prevail.*

Morbid Anatomy.—The changes result from the disintegration of the red blood-corpuscles, accumulation of the pigment thereby formed, and possibly the influence of toxic materials produced by the parasite. Cases of simple malarial infection, the ague, are rarely fatal, and our knowledge of the morbid anatomy of the disease is drawn from the pernicious malaria or the chronic cachexia. Rupture of the enlarged spleen may occur spontaneously, but more commonly from trauma. A case of the kind was admitted under my colleague, Halsted, in June, 1889, and Dock has recently reported two cases.

(1) **Pernicious Malaria.**—The condition depends upon the duration of the infection and upon whether the patient has had previous attacks. The blood is hydræmic and the serum may even be tinged with hæmoglobin. The red blood-corpuscles present the endoglobular forms of the parasite and are in all stages of destruction. The spleen is enlarged, often only moderately; thus, of two fatal cases recently in my wards the spleens measured 13 × 8 ctm. and 14 × 8 ctm. respectively. If a fresh

* One rises from the perusal of the recent *Traité des Maladies des Pays Chauds*, by Kelsch and Kiener, with a feeling that the key to many of the complex problems there discussed and a totally different conception of many of the features of malaria would have been obtained had they studied the disease from the standpoint of their countryman Laveran.

Oct. 7 92. During my absence in St Paul one spring
resident tapped a mal and spleen in the ward.
The man bled to death. see autopsy of above date.

infection, the spleen is usually very soft, and the pulp lake-colored and turbid. In cases of intense reinfection the spleen may be enlarged and firm. The amount of pigment in the spleen elements is enormously increased. The liver is swollen and turbid. In very acute cases there is not necessarily any macroscopic pigmentation, though microscopically the capillaries may be stuffed with degenerating red blood-corpuscles deeply pigmented. Perivascular (portal) infiltration has been found in a very acute case in a young man (Dock). The brain usually shows interesting changes. In severe cases of some duration the tissue is stained, sometimes chocolate-colored. In mild cases the discoloration is present, but less marked. The blood-vessels, especially the arterioles and capillaries, contain large numbers of parasites, with partial or total destruction of red blood-corpuscles, and pigmented leucocytes. Occlusions of arterioles by means of parasites are often seen. Anæmia and œdema are commoner than congestion. The kidneys show analogous conditions.

(2) **Malarial Cachexia.**—A patient, the subject of chronic paludism, usually dies of anæmia or of hæmorrhage associated with it. The most characteristic cases of the kind which have come under my observation have been in the workmen returning from the Panama Canal, victims of the so-called Chagres fever

The anæmia is profound, particularly if the patient has died of fever. The spleen is greatly enlarged, and may weigh from seven to ten pounds. If the disease has persisted for any length of time, it is firm and resists cutting. The capsule is thickened, the parenchyma brownish or yellowish-brown, with areas of pigmentation, or in very protracted cases it is extremely melanosed, particularly in the trabeculæ and about the vessels.

The liver may be greatly enlarged; but, as a rule, the increase in size is moderate in proportion to that of the spleen. It may present to the naked eye a grayish-brown or slate color due to the large amount of pigment. In the portal canals and beneath the capsule the connective tissue is impregnated with melanin. Varying with the duration of the disease, the shade of color of the liver ranges from a light gray to a deep slate-gray tint. The texture is firm, but there is not necessarily any great increase in the connective tissue. Histologically, the pigment is seen in the Kupffer's cells and the perivascular tissue.

The kidneys may be enlarged and present a grayish-red color, or areas of pigmentation may be seen. The pigment may be diffusely scattered and particularly marked about the blood-vessels and the Malpighian bodies, or it is often abundant in the cells of the convoluted and collecting tubules. The peritonæum is usually of a deep slate-color. The mucous membrane of the stomach and intestines may have the same hue, due to the pigment in and about the blood-vessels. In some cases this is confined to the lymph nodules of Peyer's patches, causing the shaven-beard appearance.

(3) **The Accidental and Late Lesions of Malarial Fever.**

(*a*) *The Liver.*—Paludal hepatitis plays a very important *rôle* in the history of malaria, as described by French writers. Kelsch and Kiener devote over sixty pages to a description of the various forms, parenchymatous and interstitial, describing under the latter three different varieties. The perusal of this section of their work by no means carries conviction that all the forms which they describe are associated definitely with malaria. Many of the patients were the subjects of chronic alcoholism, and the most important diagnostic point upon which they seem to have placed reliance was melanosis of the spleen, sometimes with pigmentation of Glisson's sheath. The existence of a cirrhosis dependent upon the irritation of large quantities of pigment in the liver is unquestioned, but only those cases in which the history of chronic malaria is definite, and in which the melanosis of both liver and spleen coexist, should be regarded as of paludal origin. The affection in this country is of extraordinary rarity. In the post-mortem room of the Philadelphia Hospital I have frequently seen, in subjects in whom the spleen was deeply pigmented, the portal sheaths of the liver stained, and a slight increase in the connective tissue; but it is begging the question to say that in such patients, who have almost certainly been habitual consumers of bad whisky, the condition of the liver was due to malaria. No instance of malarial cirrhosis has been shown at the Philadelphia Pathological Society since its foundation. Welch tells me he knows of but one specimen which has been shown in New York, and that was from an Algerian.

(*b*) *Pneumonia* is believed by many authors to be common in malaria, and even to depend directly upon the malarial poison, occurring either in the acute or in the chronic forms of the disease. I have no personal knowledge of such a special pneumonia It certainly does not occur in the intermittent or remittent fevers which prevail in Philadelphia and Baltimore. The question was formerly warmly discussed in this country, and I may refer to the attempt on the part of Manson to distinguish special forms depending upon the malarial poison. The exhaustive and critical review of the subject by W. T. Howard, in 1859, put a check to many of the speculations on the subject. The French authors quoted above recognize as common in chronic paludism a form distinguished by an irregular course, an absence of many of the characteristic symptoms, by a rapid swelling of the liver and spleen, and a special tendency to the formation of necrotic foci. On two occasions in the Philadelphia Hospital I had an opportunity of seeing the development of pneumonia in convalescents from malaria—one of a quotidian, the other of a quartan type. They developed in a ward with several other cases of pneumonia, and the disease ran a perfectly normal course. In about four hundred cases of malaria which have been under observation at the Johns Hopkins Hospital and Dispensary bronchitis has been frequent as an early symptom,

but we have seen no indication of any special form of inflammation of the lungs.

(*c*) *Nephritis.*—Acute inflammation of the kidneys is rare in the milder forms. Albumen in the urine is not infrequent during the chill, and in the course of the continued or remittent fevers. Kelsch and Kiener describe several forms of nephritis. No instance of acute or chronic Bright's disease resulting directly from paludism has come under my notice.

Clinical Forms of Malarial Fever.—(1) **Intermittent Fever.**—This form is characterized by recurring paroxysms of what are known as ague, in which, as a rule, chill, fever, and sweat follow each other in orderly sequence. The stage of *incubation* may be very short. Attacks have occurred within twenty-four hours after exposure. Usually the time of incubation is from seven to fourteen days. On the other hand, the ague may be, as is said, "in the system," and the patient may have a paroxysm months after he has removed from a malarial region, though I doubt if this can be the case unless he has had the disease when living there.

Description of the Paroxysm.—The patient generally knows he is going to have a chill a few hours before its advent by unpleasant feelings and uneasy sensations, sometimes by headache. The paroxysm is divided into three stages—cold, heat, and sweating.

Cold Stage.—The onset is indicated by a feeling of lassitude and a desire to yawn and stretch, by headache, uneasy sensations in the epigastrium, sometimes by nausea and vomiting. Even before the chill begins the thermometer indicates slight rise in temperature. Gradually the patient begins to shiver, the face looks cold, and in the fully developed rigor the whole body shakes, the teeth chatter, and the movements may often be violent enough to shake the bed. Not only does the patient look cold and blue, but a surface thermometer will indicate a reduction of the skin temperature. On the other hand, the axillary or rectal temperature may, during the chill, be greatly increased, and, as shown in the chart, the fever may rise during the chill to 105° or 106°. Of symptoms associated with the chill, nausea and vomiting are common. There may be intense headache. The pulse is quick, small, and hard. The urine is increased in quantity. The chill lasts for a variable time, from ten or twelve minutes to an hour, or even longer.

The *hot stage* is ushered in by transient flushes of heat; gradually the coldness of the surface disappears and the skin becomes intensely hot. The contrast in the patient's appearance is striking: the face is flushed, the hands are congested, the skin reddened, the pulse is full and bounding, the heart's action is forcible, and the patient may complain of a throbbing headache. The rectal temperature may not increase much during this stage; in fact, by the termination of the chill the fever may have reached its maximum. The duration of the hot stage varies from half an

No. 779 Clarence Jones ADMITTED Jan. 30th 1890 WARD

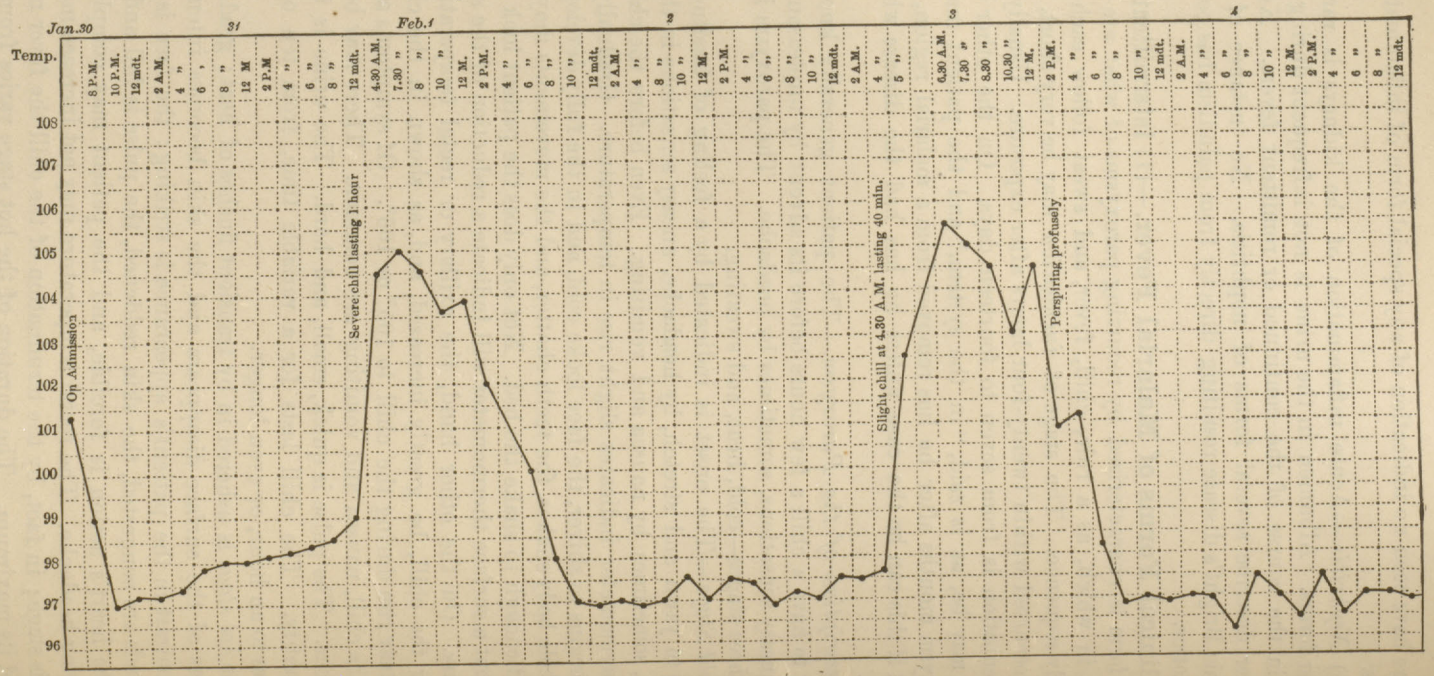
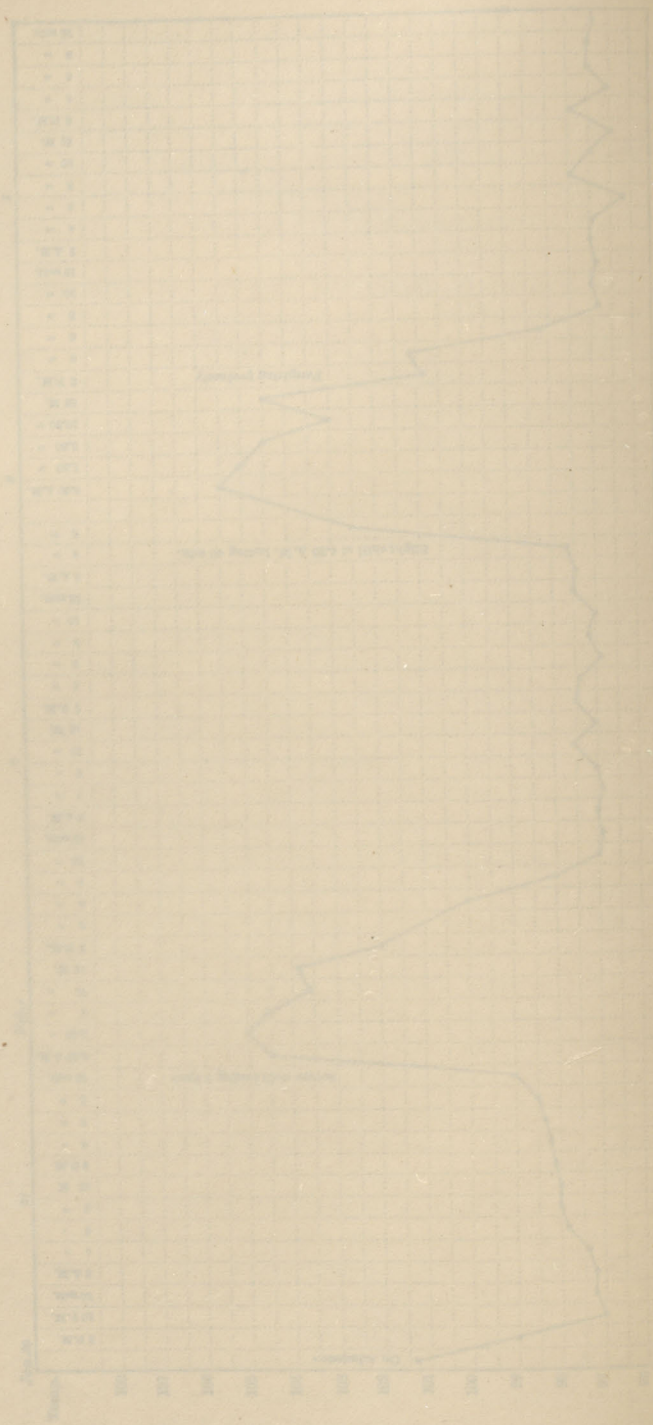


CHART XI.





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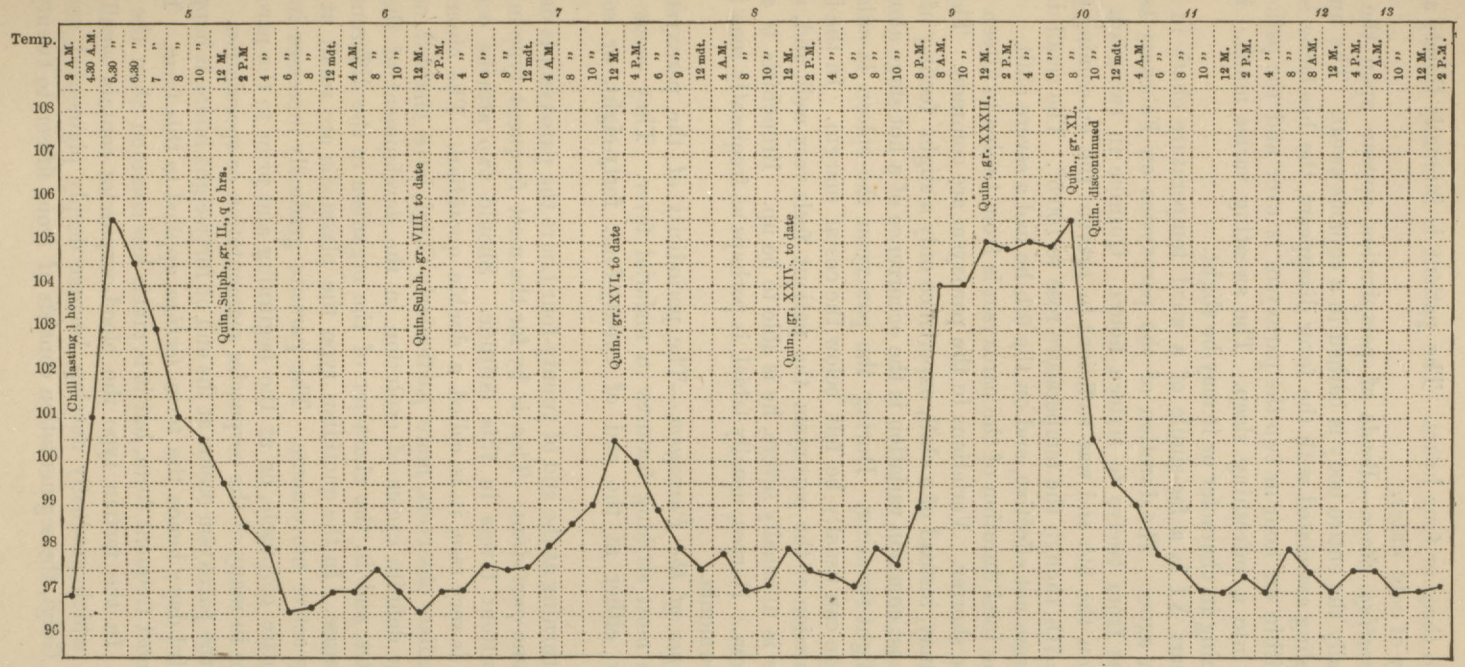


CHART XI.—*(Continued).*

hour to three or four hours. The patient is intensely thirsty and drinks eagerly of cold water.

Sweating Stage.—Beads of perspiration appear upon the face and gradually the entire body is bathed in a copious sweat. The uncomfortable feeling associated with the fever disappears, the headache is relieved, and within an hour or two the paroxysm is over and the patient usually sinks into a refreshing sleep. The sweating varies much. It may be drenching in character or it may be slight.

Chart XI is a fac-simile of a ward temperature chart in a case of tertian ague. The duration of the paroxysms on February 1st, 3d, and 5th was from twelve to sixteen hours. Quinine in two-grain doses was given on the 5th and was sufficient to prevent the on-coming paroxysms on the 7th, though the temperature rose to 100·5°. The small doses, however, were not effective, and on the 9th he had a severe chill.

The total duration of the paroxysm is from twelve to fifteen hours, but may be shorter. Variations in the paroxysm are common. Thus the patient may, instead of a chill, experience only a slight feeling of coldness. The most common variation is the occurrence of a hot stage alone, or with very slight sweating. During the paroxysm the spleen is enlarged and the edge can usually be felt below the costal margin. In the interval or intermission of the paroxysm the patient feels very well, and, unless the disease is unusually severe, he is able to be up. Bronchitis is a common symptom. Herpes, usually labial, is perhaps as frequently seen in ague as in pneumonia.

Types of the Paroxysm.—The periodicity of the paroxysms is one of the most striking features in malarial fever. They occur with regularity, either at the end of twenty-four. forty-eight, or seventy-two hours.

Returning at the end of twenty-four hours the paroxysm is daily, hence the name *quotidian.* This is by far the most frequent type in the acute intermittent fevers in this latitude. Should two attacks occur daily, which is very rare, it is called a double quotidian. The observations of the Italian observers, more particularly Golgi, have enabled us to trace certain definite cycles of evolution in the development of the malarial parasites, and in the character of the organism in the different forms of the disease. In the quotidian type the plasmodia are small at first and display active movements. The parasite gradually increases in size, fills the entire corpuscle, or at the beginning and prior to the paroxysm undergoes in many of the corpuscles segmentation or sporulation.

If the paroxysm occurs at the end of forty-eight hours, it happens upon the third day; hence the term *tertian* applied to this form. This is the next most frequent form, but it is much less common than the quotidian form. In the tertian type the blood-corpuscles contain small amœboid bodies which gradually develop, become deeply pigmented, and, according to Golgi, the segmentation consists of from fifteen to twenty separate

bodies, aggregated about the central clump of pigment. Here, too, the segmentation occurs just prior to and during the chill.

Occurring at the end of seventy-two hours the paroxysm is on the fourth day, hence the name *quartan* ague. This is rare, and in the past seven years I have met with but six or eight well-marked instances. In this form the amœboid bodies become rapidly pigmented. The movements are slower. They grow gradually in the red blood-corpuscles, and, according to Golgi, attain considerable size without removing all the hæmoglobin from the corpuscles. Prior to the chill, segmentation of the bodies takes place into from nine to twelve different portions.

Other types, such as quintan or sextan, need not be considered, as they are very rare.

Course of the Disease.—After a few paroxysms, or after the disease has persisted for ten days or two weeks, the patient may get well without any special medication. In cases in which we have been studying the hæmatozoa I have repeatedly known the chills to stop spontaneously. Such cases, however, are very liable to recurrence. Persistence of the fever leads to anæmia and a hæmatogenous jaundice, owing to the destruction of the red blood-disks by the parasites. Ultimately the condition may become chronic, and will be described under malarial cachexia. Cases of intermittent fever yield promptly and immediately to treatment by quinine.

(2) **Continued and Remittent Form of Malarial Fever.**—Under this head will be described that form of fever in which there are no distinct intermissions, but in which the temperature range is constantly above normal, though there are marked remissions. It is not an uncommon disease in this locality. The severer forms of it prevail in the Southern States and in tropical countries where it is known chiefly as *bilious remittent fever*. The entire group of cases included under the terms *remittent fever*, *bilious remittent*, and *typho-malarial fevers* requires to be studied anew in the light of Laveran's observations.

Symptoms.—The disease may set in with a definite chill, or may be preceded for a few days by feelings of *malaise*. As seen in this latitude, the patient has either chilliness or a distinct rigor in the beginning. When seen on the second or third day of the disease he has a flushed face and looks ill. The tongue is furred, the pulse is full and bounding, but rarely dicrotic. The temperature may range from 102° to 103°, or is in some instances higher. The general appearance of the patient is strongly suggestive of typhoid fever, a suggestion still further borne out by the existence of acute splenic enlargement of moderate grade. As in intermittent fever, an initial bronchitis may be present. The course of these cases is variable. The fever is continuous, with remissions more or less marked; definite paroxysms with or without chills may occur, in which the temperature rises to 105° or 106°. Intestinal symptoms are not present. A slight hæmatogenous jaundice may develop early. Delirium, usually of a

mild type, may occur. The cases vary greatly in severity. In some the fever subsides at the end of the week, and the practitioner is in doubt whether he has had to do with a mild typhoid or a simple febricula. In other instances the fever persists for from ten days to two weeks, there are marked remissions, perhaps chills, with a furred tongue and low delirium. Jaundice is not infrequent. These are the cases to which the term bilious remittent and typho-malarial fevers are applied. In other instances the symptoms become grave and assume a character of the pernicious type. It is this form of malarial fever about which so much confusion still exists. The similarity of the cases at the outset to typhoid fever is most striking, more particularly the appearance of the facies, and the patient *looks* very ill. The cases develop, too, in the autumn, at the very time when typhoid fever occurs. The fever yields, as a rule, promptly to quinine, though here and there cases are met with, rarely indeed in my experience, in which they are refractory. It is just in this group that the observations of Laveran will be found of the greatest value.

The *diagnosis* of malarial remittent fever may be definitely made by the examination of the blood. Vandyke Carter, in his monograph, alludes to the value of this method in the fevers of India. In many cases here we are at first unable to distinguish between typhoid and continued malarial fever without a blood examination. A more wide-spread use of this means of diagnosis will enable us to bring some order out of the confusion which exists in the classification of the fevers of the South. At present the following febrile affections are recognized by various physicians as occurring in the subtropical regions of this continent: (*a*) Typhoid fever; (*b*) typho-malarial fever, a typhoid modified by malarial infection, or the result of a combined infection; (*c*) the malarial remittent fever; and (*d*) continued thermic fever (Guitéras). In these various forms, all of which may be characterized by a continued pyrexia with remissions or with chills and sweats (for we must remember that chills and sweats in typhoid fever are by no means rare), the blood examination will enable us to discover those which depend upon the malarial poison. In this latitude we have not the opportunity of seeing many of the protracted and severe cases, but I am inclined to think that future observations will show that apart from the thermic fever there are only two forms of these continued fevers in the South—the one due to the *typhoid*, and the other to the *malarial* infection. The typhoid fever of Philadelphia and Baltimore presents no essential difference from the disease as it occurs in Montreal, a city practically free from malaria. Dock has shown conclusively that cases diagnosed in Texas as continued malarial fever were really true typhoid.

(3) **Pernicious Malarial Fever.**—This is fortunately rare in temperate climates, and the number of cases which now occur, for example, in Philadelphia and Baltimore, is very much less than thirty or forty years ago. Among the cases of malaria which have been under observation during

As pointed out by Joseph Jones this form may occur in chronic paludism (see Observations Vol II p. 14

the past two years there were only two of the pernicious form. The following are the most important types:

(*a*) The *comatose form*, in which a patient is struck down with symptoms of the most intense cerebral disturbance, either acute delirium or, more frequently, a rapidly developing coma. A chill may or may not precede the attack. The fever is usually high, and the skin hot and dry. The unconsciousness may persist for from twelve to twenty-four hours, or the patient may sink and die. After regaining consciousness a second attack may come on and prove fatal.

(*b*) *Algid Form.*—In this, the attack sets in usually with gastric symptoms; there are vomiting, intense prostration, and feebleness out of all proportion to the local symptoms. The patient complains of feeling cold, although there may be no actual chill. The temperature may be normal or even subnormal; consciousness may be retained. The pulse is feeble and small, and the respirations are increased. The urine is often diminished or even suppressed. This condition may persist with slight exacerbations of fever for several days and the patient may die in a condition of profound asthenia. In a recent case the patient, admitted on October 10th, had been ill since the 7th, but there were no chills. When first seen he was prostrated and weak, and looked as if he had been drinking, but there was no alcoholic odor of the breath, and on learning that he had recently come from Savannah, the blood was at once examined and large numbers of Laveran's organisms were found, chiefly of the small intracorpuscular variety. The temperature was only 101°. During the next five days the prostration, extreme depression, and vomiting continued; the pulse ranged from 70 to 80, and the temperature, after the first day, did not rise above 98°, but sank as low as 96°. This is essentially the same as described as the *asthenic* or *adynamic* form of the disease.

(*c*) *Hæmorrhagic Forms.*—In all the severe types of malarial infection, especially if persistent, hæmorrhage may occur from the mucous membranes. An important form is the malarial *hæmaturia*, which in some instances assumes a very malignant type. Paroxysms of ague may precede the attack, but in many cases called malarial hæmaturia there is no febrile paroxysm. The condition is usually hæmoglobinuria, though blood-corpuscles are present also. In severe cases there is bleeding from the mucous membranes. Jaundice is present, but to a variable extent, and is hæmatogenous, due to the destruction of the red blood-corpuscles. Malarial hæmaturia occurs in epidemic form in many regions of the Southern States, and in some seasons proves very fatal.

Many different forms of pernicious malarial fever—diaphoretic, syncopal, pneumonic, pleuritic, choleraic, cardiac, gastric, and gangrenous—all of which depend upon some special symptom, have been described.

(4) **Malarial Cachexia.**—The symptoms of chronic malarial poisoning are very varied. It may follow the frequent recurrence of ordinary intermittent fever, a common sequence in this country. A patient has chills

for several weeks, is improperly or imperfectly treated, and on exposure the chills recur. This may be repeated for several months until the patient presents the two striking features of malarial cachexia—namely, *anæmia* and an *enlarged spleen*. Cases developing without chills or without febrile paroxysms are almost unknown in this region. They may occur, however, in intensely malarial districts, but in such cases the patients have fever, though chills may not supervene. The most pronounced types of malarial cachexia which we meet with here are in sailors from the West Indies and Central America. There is profound anæmia; the blood count may be as low as one million per cubic millimetre; the skin has a saffron-yellow or lemon tint, not often the light-yellow tint of pernicious anæmia, but a darker, dirtier yellow. The spleen is greatly enlarged, firm, and hard. It rarely reaches the dimensions of the large leukæmic organ, but comes next to it in size.

The general symptoms are those of ordinary anæmia—breathlessness on exertion, œdema of the ankles, hæmorrhages, particularly into the retina, as noted by Stephen Mackenzie. Occasionally the bleeding is severe, and I have twice known fatal hæmatemesis to occur in association with the enlarged spleen. The fever is variable. The temperature may be low for days, not reaching above 99·5°. In other instances there may be irregular fever, and the temperature rises gradually to 102·5° to 103°. The cases in fact present a picture of splenic anæmia.

With careful treatment the outlook is good, and a majority of cases recover. The spleen is gradually reduced in size, but it may take several months or, indeed, in some instances, several years before the ague-cake entirely disappears.

Among the rarer symptoms which may develop as a result of malarial intoxication may be mentioned *paraplegia*, cases of which have been described by Gibney, Suckling, and others. Some of the cases are doubtful, and have been attributed to malaria simply because the paralysis was intermittent. It is a condition of extreme rarity. No case is mentioned by Kelsch and Kiener. Suckling's case had had several attacks of malaria, the last of which preceded by about two weeks the onset of the nervous symptoms, which were headache, giddiness, loss of speech, and paraplegia. The attack was transient, but he had a subsequent attack which also followed an ague-fit. The patient was an old soldier who had had syphilis, a point which somewhat complicated the case. *Orchitis* has been described as developing in malaria by Charvot in Algiers and Fedeli in Rome.

Diagnosis.—The diagnosis of the various forms of malaria is usually easy. The continued and remittent and certain of the pernicious cases offer difficulties, which, however, are now greatly lessened or entirely overcome since Laveran's researches have given us a positive diagnostic indication. Many forms of intermittent pyrexia are mistaken for malarial fever, particularly the initial chills of tuberculosis and of septic infection.

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If the practitioner will take to heart the lesson that an intermittent fever which resists quinine is not malarial, he will avoid many errors in diagnosis. In the so-called masked intermittent or dumb ague, the febrile manifestations are more irregular and the symptoms less pronounced; but occasionally chills occur, and the therapeutical test usually removes every doubt in the diagnosis.

The malarial poison is supposed to influence many affections in a remarkable way, giving to them a paroxysmal character. A whole series of minor ailments and some more severe ones, such as neuralgia, are attributed to certain occult effects of paludism. The more closely such cases are investigated the less definite appears the connection with malaria. Practitioners in districts entirely exempt from the disease have to deal with ailments which present the same odd periodicity, and which the physicians of the Atlantic coast attribute to a "touch of malaria."

Treatment.—We do not know as yet how the poison reaches the system. Infection seems most liable to occur at night. In regions in which the disease prevails extensively the drinking-water should be boiled. Persons going to a malarial region should take about ten grains of quinine daily. During the paroxysm the patient should, in the cold stage, be wrapped in blankets and given hot drinks. The reactionary fever is rarely dangerous even if it reaches a high grade. The body may, however, be sponged. Quinine should then be ordered, so as to check the on-coming paroxysm. It should be given in solution. From ten to thirty grains in divided doses through the day will almost invariably stop the next paroxysm. No preparatory treatment is necessary; no other drugs need be given. The remedy is a specific in the truest sense of the term. In not a single instance among the several hundred cases of intermittent fever which I have had under observation during the past seven years did quinine fail to check the paroxysms. The mode of administration is of little moment, so long as the patient gets a sufficient quantity into his system. In solution or in capsule it is the most efficient. The pills and compressed tablets are more uncertain, as they may not be dissolved. A question of interest is the efficient dose of quinine necessary to cure the disease. I have a number of charts showing that grain doses three times a day will, in many cases, prevent the paroxysm, but not always with the certainty of the larger doses. It is safer to give at least from twenty to thirty grains daily for the first three days and then to continue the remedy in smaller doses for two or three weeks. Other remedies in acute forms of malaria are useless.

In the pernicious forms, and when it is desirable to get the system as rapidly under its influence as possible, the drug should be administered hypodermically (as the bisulphate in thirty-grain doses with five grains of tartaric acid) every two or three hours. For the extreme restlessness in these cases opium is indicated, and cardiac stimulants (such as alcohol and strychnine) are necessary. If in the comatose form the internal tem-

perature is raised, the patient should be put in a bath and douched with cold water.

For malarial anæmia, iron and arsenic are indicated.

XXII. ANTHRAX.

(Malignant Pustule; Splenic Fever; Charbon; Wool-sorter's Disease.)

Definition.—An acute infectious disease caused by the *bacillus anthracis*. It is a wide-spread affection in animals, particularly in sheep and cattle. In man it occurs sporadically or as a result of accidental absorption of the virus.

Etiology.—The infectious agent is a non-motile, rod-shaped organism, the *bacillus anthracis*, which has, by the researches of Pollender, Davaine, Koch, and Pasteur, become the best known perhaps of all pathogenic microbes. The bacillus has a length of from two to ten times the diameter of a red blood-corpuscle; the rods are often united. They multiply by fission with great rapidity and grow with facility on various culture media, extending into long filaments which interlace and produce a dense mycelium. The spore formation is seen with great readiness in these filaments. The bacilli themselves are readily destroyed, but the spores are very resistant, and survive after prolonged immersion in a five-per-cent solution of carbolic acid, and resist for some minutes a temperature of 212° Fahr. They are capable also of resisting gastric digestion. Outside the body the spores are in all probability very durable.

Geographically and zoölogically the disease is the most wide-spread of all infectious disorders. It is much more prevalent in Europe and in Asia than in America. The ravages among the herds of cattle in Russia and Siberia, and among sheep in certain parts of Europe, are not equalled by any other animal plague. In this country the disease is rare. So far as I know it has never prevailed on the ranches in the Northwest, but cases were not infrequent about Montreal.

A protective inoculation with a mitigated virus has been introduced by Pasteur, and has been adopted in certain anthrax regions. Hankin has isolated from the cultures an albumose which renders animals immune against the most intense virus.

In animals the disease is conveyed sometimes by direct inoculation, as by the bites and stings of insects, by feeding on carcasses of animals which have died of the disease, but more commonly by feeding in pastures in which the germs have been preserved. Pasteur believes that the earthworm plays an important part in bringing to the surface and distributing the bacilli which have been propagated in the buried carcass of an infected animal. Certain fields, or even farms, may thus be infected for an indefinite period of time. It seems probable, however, that if the carcass

ask Salmon about Anthrax in the
Ranches.

perature is raised, the patient should be put in a bath and douched with cold water.

For malarial anæmia, iron and arsenic are indicated.

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In a recent case in a hair-picker the ~~lesions~~ were most extensive internal ~~lesions~~ ~~on the pustules~~ and ~~endoveas~~ ditus, ~~while~~ latter lesion ~~has been~~ described by Eppinger.

is not opened or the blood spilt, spores are not formed in the buried animal.

Animals vary in susceptibility: herbivora in the highest degree, then the omnivora, and lastly the carnivora. The disease does not occur spontaneously in man, but always results from infection, either through the skin, the intestines, or in rare instances through the lungs. The disease is found in persons whose occupations bring them into contact with animals or animal products, as stablemen, shepherds, tanners, butchers, and those who work in wool and hair.

Various forms of the disease have been described, and two chief groups may be recognized: the external anthrax, or malignant pustule, and the internal anthrax, of which there are pulmonary and intestinal forms.

Symptoms.—(1) **External Anthrax.**

(*a*) *Malignant Pustule.*—The inoculation is usually on an exposed surface—the hands, arms, or face. At the site of inoculation there are, within a few hours, itching and uneasiness. Gradually a small papule develops, which becomes vesicular. Inflammatory induration extends around this, and within thirty-six hours, at the site of inoculation there is a dark brownish eschar, at a little distance from which there may be a series of small vesicles. The brawny induration may be extreme. The œdema produces very great swelling of the parts. The inflammation extends along the lymphatics, and the neighboring lymph-glands are swollen and sore. The temperature at first rises rapidly, and the febrile phenomena are marked. Subsequently the fever falls, and in many cases becomes subnormal. Death may take place in from three to five days. In cases which recover the constitutional symptoms are slighter, the eschar gradually sloughs out, and the wound heals. The cases vary much in severity. In the mildest form there may be only slight swelling. At the site of inoculation a papule is formed, which rapidly becomes vesicular and dries into a scab, which separates in the course of a few days.

(*b*) *Malignant Anthrax Œdema.*—This form occurs in the eyelid, and also in the head, hand, and arm, and is characterized by the absence of the papule and vesicle forms, and by the most extensive œdema, which may follow rather than precede the constitutional symptoms. The œdema reaches such a grade of intensity that gangrene results, and may involve a considerable surface. The constitutional symptoms then become extremely grave, and the cases invariably prove fatal.

A feature in both these forms of malignant pustule, to which many writers refer, is the absence of feeling of distress or anxiety on the part of the patient, whose mental condition may be perfectly clear. He may be without any apprehension, even though his condition is very critical.

The *diagnosis* in most instances is readily made from the characters of the lesion and the occupation of the patient. When in doubt, the examination of the fluid from the pustule may show the presence of the anthrax bacilli. Cultures should be made, or a mouse or guinea-pig inocu-

lated. It is to be remembered that the blood may not show the bacilli in numbers until shortly before death.

(2) **Internal Anthrax.**

(*a*) *Intestinal Form, Mycosis intestinalis.*—In these cases the infection is through the stomach and intestines, and results from eating the flesh or drinking the milk of diseased animals. The symptoms are those of intense poisoning. The disease may set in with a chill, followed by vomiting, diarrhœa, moderate fever, and pains in the legs and back. In acute cases there are dyspnœa, cyanosis, great anxiety and restlessness, and toward the end convulsions or spasms of the muscles. Hæmorrhage may occur from the mucous membranes. Occasionally there are small phlegmonous areas on the skin, or petechiæ develop. The spleen is enlarged. The blood is dark and remains fluid for a long time after death. Late in the disease the bacilli may be found in the blood.

This is one of the forms of acute poisoning which may affect many individuals together. Thus Butler and Karl Huber describe an epidemic in which twenty-five persons were attacked after eating the flesh of an animal which had had anthrax. Six died in from forty-eight hours to seven days.

(*b*) *Wool-sorter's Disease.*—This important form of anthrax is found in the large establishments in which wool or hair is sorted and cleansed. The hair and wool imported into Europe from Russia and South America appear to have induced the largest number of cases. Many of these cases show no external lesion. The infection has been swallowed or inhaled with the dust. There are rarely premonitory symptoms. The patient is seized with a chill, becomes faint and prostrated, has pains in the back and legs, and the temperature rises to 102° to 103°. The breathing is rapid, and he complains of much pain in the chest. There may be a cough and signs of bronchitis. So prominent in some instances are these bronchial symptoms that a pulmonary form of the disease has been described. The pulse is feeble and very rapid. There may be vomiting, and death may occur within twenty-four hours with symptoms of profound collapse and prostration. Other cases are more protracted, and there may be diarrhœa, delirium, and unconsciousness. The recognition of wool-sorter's disease as a form of anthrax is due to J. H. Bell, of Bradford, England.

In certain instances these profound constitutional symptoms of internal anthrax are associated with the external lesions of malignant pustule.

The diagnosis of internal anthrax is by no means easy, unless the history points definitely to infection in the occupation of the individual. In cases of doubt cultures should be made, and inoculations performed in animals. Some of these cases may possibly be caused by organisms other than the bacillus of anthrax (Cornil and Babes).

Treatment.—In malignant pustule the site of inoculation should be destroyed by the caustic or hot iron, and powdered bichloride of mercury

The Rag pickers disease has been made the subject of an exhaustive study by Eppinger (Die Hadernkrankheit. Jena. 1894) who has shown that it is a local anthrax of the lungs and pleura with general infection

XXIII. RABIES.

(Lyssa; Hydrophobia.)

Definition.—An acute disease of animals, dependent upon a specific virus, and communicated by inoculation to man.

Etiology.—In man the disease is very variously distributed. In Russia at Novocastle, in North Germany it is extremely rare, owing to the wise provision that all dogs shall be muzzled. In England and France it is much more common. In this country the disease is very rare. Since 1887 I have seen but two cases.

Canines are especially liable to the disease. It is found most frequently in the dog, the wolf, and the cat. All animals are, however, susceptible, and it is communicable by inoculation to the ox, horse, or pig. The disease is propagated chiefly by the dog, which seems specially susceptible. In the Western States the skunk is said to be very liable to the disease. The nature of the poison is as yet unknown. It is contained chiefly in the nervous system and is met with in the secretions, particularly in the saliva.

A rabid animal is usually dangerous from the time the symptoms appear, but it is probable that the saliva is sometimes infectious before the symptoms appear. The former are most frequently attacked. (b) Sex infected. The rapidity of onset of the symptoms is greatly determined by the part of the body which may happen to have been bitten. Wounds about the face and head are especially dangerous; next in order in degree of mortality come bites on the hands, then injuries on the other parts of the body. This relative order is, no doubt, greatly dependent upon the fact that the face, head, and hands are usually naked, while the other parts are clothed. (c) The extent and severity of the wound. Puncture wounds are the most dangerous; the lacerations are fatal in proportion to the extent of the surface afforded for absorption of

The cerebral symptoms may be most intense and in at least four cases the brain seems to have been chiefly affected + the capillaries stuffed with bacilli (Meckel)

Dulles ~~has called attention to the~~ could collect only 78 cases in the five & a half years ending Dec. 31 1892

may be sprinkled over the exposed surface. The local development of the bacilli about the site of inoculation may be prevented by the subcutaneous injections of solutions of carbolic acid or bichloride of mercury. The injections should be made at various points around the pustule, and may be repeated two or three times a day. The internal treatment should be confined to the administration of stimulants and plenty of nutritious food. Davies-Colley advises ipecacuanha powder in doses of from five to ten grains every three or four hours.

In malignant forms, particularly the intestinal cases, little can be done. Active purgatives may be given at the outset, so as to remove the infecting material. Quinine in large doses has been recommended.

XXIII. ~~RABIES.~~ Hydrophobia

(*Lyssa*; ~~*Hydrophobia.*~~) Rabies

Definition.—An acute disease of animals, dependent upon a specific virus, and communicated by inoculation to man.

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A variable time elapses between the introduction of the virus and the appearance of the symptoms. Horsley states that this depends upon the following factors: "(*a*) Age. The incubation is shorter in children than in adults. For obvious reasons the former are more frequently attacked. (*b*) Part infected. The rapidity of onset of the symptoms is greatly determined by the part of the body which may happen to have been bitten. Wounds about the face and head are especially dangerous; next in order in degrees of mortality come bites on the hands, then injuries on the other parts of the body. This relative order is, no doubt, greatly dependent upon the fact that the face, head, and hands are usually naked, while the other parts are clothed. (*c*) The extent and severity of the wound. Puncture wounds are the most dangerous; the lacerations are fatal in proportion to the extent of the surface afforded for absorption of

the virus. (*d*) The animal conveying the infection. In order of decreasing severity come: first, the wolf; second, the cat; third, the dog; and fourth, other animals." Only a limited number of those bitten by rabid dogs become affected by the disease; according to Horsley, not more than fifteen per cent. On the other hand, the death-rate of those persons bitten by wolves is higher, not less than forty per cent.

The incubation period in man is extremely variable. The average is from six weeks to two months. In a few cases it has been under two weeks. It may be prolonged to three months. It is stated that the incubation may be prolonged for a year or even two years, but this has not been definitely settled.

Symptoms.—Three stages of the disease are recognized:

(1) *Premonitory stage*, in which there may be irritation about the bite, or pain or numbness. The patient is depressed and melancholy; and complains of headache and loss of appetite. He is very irritable and sleepless, and has a constant sense of impending danger. There is often greatly increased sensibility. A bright light or a loud voice is distressing. The larynx may be injected and the first symptoms of difficulty in swallowing are experienced. The voice also becomes husky. There is a slight rise in the temperature and the pulse.

(2) *Furious Stage.*—This is characterized by great excitability and restlessness, and an extreme degree of hyperæsthesia. "Any afferent stimulant—i. e., a sound or a draught of air, or the mere association of a verbal suggestion—will cause a violent reflex spasm. In man this symptom constitutes the most distressing feature of the malady. The spasms, which affect particularly the muscles of the larynx and mouth, are exceedingly painful and are accompanied by an intense sense of dyspnœa, even when the glottis is widely opened or tracheotomy has been performed" (Horsley). Any attempt to take water is followed by an intensely painful spasm of the muscles of the larynx and of the elevators of the hyoid bone. It is this which makes the patient dread the very sight of water and gives the popular name to the disease. These spasmodic attacks may be associated with maniacal symptoms. In the intervals between them the patient is quiet and the mind unclouded. The temperature in this stage is usually elevated and may reach from 100° to 103°. In some instances the disease is afebrile. The patient rarely attempts to injure his attendants, and in the intense spasms may be particularly anxious to avoid hurting any one. There are, however, occasional fits of furious mania, and the patient may, in the contractions of the muscles of the larynx and pharynx, give utterance to odd sounds. This stage lasts from a day and a half to three days and gradually passes into the—

(3) *Paralytic Stage.*—In rodents the preliminary and furious stages are absent, as a rule, and the paralytic stage may be marked from the outset—the so-called dumb rabies. This stage rarely lasts longer than from six to eighteen hours. The patient then becomes quiet; the spasms no

longer occur; there is gradual unconsciousness; the heart's action becomes more and more enfeebled, and death occurs by syncope.

Morbid Anatomy.—The lesions are in the cerebro-spinal system. The blood-vessels are congested; there is perivascular exudation of leucocytes; and there are minute hæmorrhages. According to Gowers, these are particularly intense in the medulla. The pharynx is congested, the mucous membrane of the stomach is hyperæmic, and not infrequently covered with a blood-stained mucus. The larynx, trachea, and bronchi show acute congestion. There are no special changes in the abdominal or thoracic viscera. The inoculation experiments show that the virus is not present in the liver, spleen, or kidneys, but is abundant in the spinal cord and brain.

Treatment.—Prophylaxis is of the greatest importance, and by a systematic muzzling of dogs the disease can be, as in Germany, practically eradicated.

The bites should be carefully washed and thoroughly cauterized with caustic potash or concentrated carbolic acid. It is best to keep the wound constantly open for at least five or six weeks. When once established the disease is hopelessly incurable. No measures have been found of the slightest avail, consequently the treatment must be palliative. The patient should be kept in a darkened room, in charge of not more than two careful attendants. To allay the spasm, chloroform may be administered and morphia given hypodermically. It is best to use these powerful remedies from the outset, and not to temporize with chloral, bromide of potassium, and other less potent drugs. By the local application of cocaine, the sensitiveness of the throat may be diminished sufficiently to enable the patient to take liquid nourishment. Sometimes he can swallow readily. Nutrient enemata may be administered.

Preventive Inoculation.—Pasteur has found that the virus, when propagated through a series of rabbits, increases rapidly in its virulence; so that whereas subdural inoculation from the brain of a mad dog takes from fifteen to twenty days to produce the disease, in successive inoculations in a series of rabbits the incubation period is gradually reduced to seven days. The spinal cord of these rabbits contains the virus in great intensity, but when preserved in dry air the virus gradually diminishes in intensity. If now dogs are inoculated with cords preserved for from twelve to fifteen days, and then with cords preserved for a shorter period, i. e., with a progressively stronger virus, they gradually acquire immunity against the disease. A dog treated in this way will resist inoculation with material from a perfectly fresh cord from a rabid rabbit, which otherwise would inevitably have proved fatal. Relying upon these experiments, Pasteur began inoculations in the human subject using, on successive days, material from cords in which the virus was of varying degrees of intensity.

There is still much discussion as to the full value of this method, but if the protective inoculation can be successfully performed in dogs,

there is no reason why the same should not hold good for man; and the figures published annually from the Pasteur Institute show that in persons bitten by animals known to have been rabid, the mortality after inoculation is only about 0·60 per cent.

Pseudo-rabies.—This is a very interesting affection, which may closely resemble hydrophobia, but is really nothing more than a neurotic or hysterical manifestation. A nervous person bitten by a dog, either rabid or supposed to be rabid, develops within a few months, or even later, symptoms somewhat resembling the true disease. He is irritable and depressed. He constantly declares his condition to be serious and that he will inevitably become mad. He may have paroxysms in which he says he is unable to drink, grasps at his throat, and becomes emotional. The temperature is not elevated and the disease does not progress. It lasts much longer than the true rabies, and is amenable to treatment. It is not improbable that a majority of the cases of alleged recovery in this disease have been of this hysterical form. In a case which Burr reported from my clinic a few years ago the patient had paroxysmal attacks in which he could not swallow. He was greatly excited and alarmed at the sight of water and was extremely emotional. The attack lasted for a couple of weeks and yielded to treatment with powerful electrical currents.

XXV. TETANUS.

(*Lockjaw.*)

Definition.—An infectious malady characterized by tonic spasms of the muscles with marked exacerbations. The virus is produced by a bacillus which occurs in earth and sometimes in putrefying fluids and manure.

Etiology.—It occurs as an idiopathic affection or follows trauma. It is frequent in some localities and has prevailed extensively in epidemic form among new-born children, when it is known as tetanus or trismus neonatorum. It is more common in hot than in temperate climates, and in the colored than in the Caucasian race. This is particularly the case with tetanus following confinement and in tetanus neonatorum. In certain of the West India Islands more than one half of the mortality among the negro children has been due to this cause. In a majority of the cases there is an injury which may be of the most trifling character. It is more common after punctured and contused than after incised wounds, and frequently follows those of the hands and feet. The disease usually appears within two weeks of the injury. In some military campaigns tetanus has prevailed extensively, but in others, as in the late civil war, the cases have been comparatively few. Idiopathic tetanus is rare in man, but it has sometimes followed exposure to cold or after sleeping on the damp ground.

hydrophobia — lyssophobia

The infectious nature of tetanus was suggested by its endemic occurrence and from the manner of its behavior in certain institutions. Veterinarians have long been of the belief in cases are apt to occur in horses in one stable, and attention was only called to this feature by the prevalence of the disease in the eastern end of Long Island.

The Tetanus Bacillus.—The observations of Rosenbach, Nicolaïer, and Kitasato have demonstrated that there is in connection with the disease a specific organism which can be isolated and cultivated. The bacillus forms a slender rod with rounded ends and may grow into long threads. It is motile, grows at ordinary temperatures, and is anaërobic. With small quantities of the culture the disease may be transmitted to animals, which die with symptoms of tetanus. An extremely interesting fact is the separation by Brieger from the cultures as well as from a subject dead of tetanus of poisonous substances capable of producing the disease. Of these ptomaines one, *tetanin*, causes the characteristic symptoms of tetanus; another causes tremors, convulsions, and subsequently paralysis; and a third causes at once intense clonic and tonic spasms. Another point of interest is the fact that protection in animals can be procured by inoculating an animal with the blood of another which has had the disease. The organism has been found in the earth and in putrefying fluids, and Nicolaïer has caused the disease by inoculating with different sorts of surface soil.

Morbid Anatomy.—No characteristic lesions have been found in the cord or in the brain. Congestions occur in different parts and perivascular exudations and granular changes in the nerve-cells have been found. The condition of the wound is variable. The nerves are often found injured, reddened, and swollen. In the tetanus neonatorum the umbilicus may be inflamed.

Symptoms.—After an injury the disease sets in usually within ten days. In Yandell's statistics at least two fifths, and in Joseph Jones's four fifths, occurred before the fifteenth day. The patient complains at first of slight stiffness in the neck, or a feeling of tightness in the jaws, or difficulty in mastication. Occasionally chilly feelings or actual rigors may precede these symptoms. Gradually a tonic spasm of the muscles of these parts develops, producing the condition of trismus or lockjaw. The eyebrows may be raised and the angles of the mouth drawn out, causing the so-called sardonic grin—*risus sardonicus*. In children the spasm may be confined to these parts. Sometimes the attack is associated with paralysis of the facial muscles and difficulty in swallowing—the head tetanus of Rose, which has most commonly followed injuries in the neighborhood of the fifth nerve. Gradually the paroxysms extend and involve the muscles of the body. The muscles of the back are most affected, so that during the spasm the unfortunate victim may rest upon the head and heels, a position known as opisthotonos. The rectus abdominalis muscle has been torn across in the spasm. The entire trunk and limbs may be perfectly rigid—orthotonos

The infectious nature of tetanus was suggested by its endemic occurrence and from the manner of its behavior in certain institutions. Veterinarians have long been of this belief, as cases are apt to occur together in horses in one stable. In the United States attention was early called to this feature by the prevalence of the disease in the eastern end of Long Island.

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nos. Flexion to one side is less common—*pleurosthotonos;* while spasm of the muscles of the abdomen may cause the body to be bent forward—*emprosthotonos.* In very violent attacks the thorax is compressed, the respirations are rapid, and spasm of the glottis may occur, causing asphyxia. The paroxysms last for a variable period, but even in the intervals the relaxation is not complete. The slightest irritation is sufficient to cause a spasm. The paroxysms are associated with agonizing pain, and the patient may be held as in a vise, unable to utter a word. Usually he is bathed in a profuse sweat. The temperature may remain normal throughout, or show only a slight elevation toward the close. In other cases the pyrexia is marked from the outset; the temperature reaches 105° or 106°, and before death 109° or 110°. In rare instances the temperature may reach a still higher point. Death either occurs during the paroxysm from heart-failure or asphyxia, or is due to exhaustion.

Diagnosis.—Well-developed cases following a trauma could not be mistaken for any other disease. The spasms are not unlike those of strychnia-poisoning, and in the celebrated Palmer murder trial this was the plea for the defence. The jaw-muscles, however, are never involved early, if at all, and between the paroxysms in strychnia-poisoning there is no rigidity. Certain cases of the so-called cephalic tetanus in which there is difficulty of swallowing might be mistaken for hydrophobia, but in this disease there is never the stiffness of the jaws nor paroxysms in which the cervical and dorsal muscles are affected. In tetany the distribution of the spasm at the extremities, the peculiar position, the greater involvement of the hands, and the condition under which it occurs, are sufficient to make the diagnosis clear.

Prognosis.—Two of the Hippocratic aphorisms express tersely the general prognosis even at the present day: "The spasm supervening on a wound is fatal," and "such persons as are seized with tetanus die within four days, or if they pass these they recover."

The mortality in the traumatic cases is not less than eighty per cent. (Conner); in the idiopathic cases it is under fifty per cent. According to Yandell the mortality is greatest in children. Favorable indications are —late onset of the attack, localization of the spasms to the muscles of the neck and jaw, and an absence of fever. Most of the cases of Rose's head tetanus, the so-called *tetanus hydrophobicus*, recover.

Treatment.—The patient should be kept in a darkened room, absolutely quiet, and attended by only one person. All possible sources of irritation should be avoided. Veterinarians appreciate the importance of this complete seclusion, and in well-equipped infirmaries there may be seen a brick padded chamber in which these cases are treated.

When the lockjaw is extreme it may be impossible to feed the patient, under which circumstances it is best to use rectal injections, or to feed by a catheter passed through the nose. The spasm should be controlled by chloroform, which may be repeatedly given at intervals. It is more satis-

The cephalic tetanus (kopftetanus of Rose) originates usually from a wound on one side of the head - and is characterized by stiffness of the muscles of the jaw and paralysis of the facial muscles on the same side as the wound - with difficulty of swallowing. The prognosis is usually as good.

Inoculate by drop

" In doubtful cases cultures should be made from the pus of the wound

Mikuliz

~~Treatment of the~~

The results of blood serum therapy have been most encouraging. ~~Animals may be rendered immune to the disease and~~ Tizzoni & Cantani have ~~treated~~ used an antitoxin prepared from the blood serum of immunised animals. The material which is known as Merk and Otto can be obtained from cannes in tubes containing 4 to 5 grammes It can be obtained in this country from Behring. It must be used as early as possible.

The life chances is the most common of these cerebro-spinal forms and is often acquired in many ways apart from direct infection;

factory to keep the patient thoroughly under the influence of morphia given hypodermically. Chloral hydrate, bromide of potassium, Calabar bean, curara, Indian hemp, belladonna, and other drugs have been recommended, and recovery occasionally follows their use. As the toxic agents appear to be produced by bacilli at the site of the lesion, thorough cleansing and antiseptic treatment should be carried out.

XXV. SYPHILIS.

Definition.—A specific disease of slow evolution, propagated by inoculation (acquired syphilis), or by hereditary transmission (congenital syphilis). In the acquired form the site of inoculation becomes the seat of a special tissue change—*primary lesion.* After an interval of two or three months constitutional symptoms develop, with affections of the skin and mucous membranes—*secondary lesions.* And, finally, after a period of three, four, or more years, granulomatous growths develop in the viscera, muscles, bones, or skin—*tertiary lesions.*

I. General Etiology and Morbid Anatomy.

The nature of the virus is still doubtful. Lustgarten found in the hard chancre and in gummata a rod-shaped bacillus of 3 or 4 μ in length, which he claims is specific and peculiar to the disease. This organism closely resembles the smegma bacillus, which is found beneath the prepuce, but from its occurrence in gummatous growths it is hardly possible that they can be identical. Further observations are required before the question can be considered settled.

Syphilis is peculiar to man, and cannot be transmitted to the lower animals. All are susceptible to the contagion, and it occurs at all ages.

Modes of Infection.—(1) In a large majority of all cases the disease is transmitted by *sexual congress*, but the designation *venereal* disease, *lues venerea*, is not always correct, as there are many other modes of inoculation.

(2) *Accidental Infection.*—In surgical and in midwifery practice, physicians are not infrequently inoculated. It is surprising that infection from these sources is not more common. I have known personally of six cases. Midwifery chancres are usually on the fingers, but I have met with one instance on the back of the hand. Lip, mouth, and tonsillar sores result as a rule from improper practices. Wet-nurses are sometimes infected on the nipple, and it occasionally happens that relatives of the child are accidentally contaminated. One of the most lamentable forms of accidental infection is the transmission of the disease in humanized vaccine lymph. This, however, is extremely rare. The conditions under which it occurs have been already referred to (see Vaccination).

(3) *Hereditary Transmission.*—This may be, and is most common,

from (*a*) the father, the mother being healthy (sperm inheritance). It is, unfortunately, an every-day experience to see cases of congenital syphilis in which the infection is clearly paternal. A syphilitic father may, however, beget a healthy child, even when the disease is fresh and full-blown. On the other hand, in very rare instances, a man may have had syphilis when young, undergo treatment, and for years present no signs of disease, and yet his first-born may show very characteristic lesions. Happily, in a large majority of instances, when the treatment has been thorough, the offspring escape. The closer the begetting to the primary sore, the greater the chance of infection. A man with tertiary lesions may beget healthy children. As a general rule it may be said that with judicious treatment the transmissive power rarely exceeds three or four years.

(*b*) Maternal transmission (germ inheritance). It is a remarkable and interesting fact that a woman who has borne a syphilitic child is herself immune, and cannot be infected, though she may present no signs of the disease. This is known as Colles's law, and was thus stated by the distinguished Dublin surgeon: "That a child born of a mother who is without obvious venereal symptoms, and which, without being exposed to any infection subsequent to its birth, shows this disease when a few weeks old—this child will infect the most healthy nurse, whether she suckle it or merely handle and dress it; and yet this child is never known to infect its own mother, even though she suckle it while it has venereal ulcers of the lips and tongue." In a majority of these cases the mother has received a sort of protective inoculation, without having had actual manifestations of the disease.

A woman with acquired syphilis is liable to bear infected children. The father may not be affected. In a large number of instances both parents are diseased, the one having infected the other, in which case the chances of fœtal infection are greatly increased.

(*c*) Placental transmission. The mother may be infected after conception, in which case the child may be, but is not necessarily, born syphilitic.

Morbid Anatomy.—The *primary lesion*, or chancre, shows: (*a*) A diffuse infiltration of the connective tissue with small, round cells. (*b*) Larger epithelioid cells. (*c*) Giant cells. (*d*) The Lustgarten bacilli, in small numbers. (*e*) Changes in the small arteries, chiefly thickening of the intima, and alterations in the nerve-fibres going to the part (Berkeley). The sclerosis is due in part to this acute obliterative endarteritis. Associated with the initial lesions are changes in the adjacent lymph-glands, which undergo hyperplasia, and finally become indurated.

The *secondary lesions* of syphilis are too varied for description here. They consist of condylomata, skin eruptions, affections of the eye, etc.

The *tertiary lesions* consist of circumscribed tumors known as gummata, and of an arteritis, which, however, is not peculiar to the disease.

Gummata.—Syphilomata develop in the bones or periosteum—here

Tourtual calls this "Loi de Baumès". Boeck
argues it down and arranged the law in
1840. Ricord wrote the paragraph on opp. page
in 1837. [Pract. Observ. on the Venereal Disease
London 1837.

they are called nodes—in the muscles, skin, brain, lung, liver, kidneys, heart, testes, and adrenals. They vary in size from small, almost microscopic, bodies to large, solid tumors from three to five centimetres in diameter. They are usually firm and hard, but in the skin and on the mucous membranes they tend to break down rapidly and ulcerate. On cross-section a medium-sized gumma has a grayish-white, homogeneous appearance, presenting in the centre a firm, caseous substance, and at the periphery a translucent, fibrous tissue. Often there are groups of three or more surrounded by dense sclerotic tissue. They are usually very firm and hard. Histologically, a small gumma consists of a granulation tissue composed of rounded cells. Owing to insufficient blood-supply, coagulation necrosis takes place in the centre with the formation of a fibro-caseous material, while the growth extends at the margins with the gradual production of fibre-cells. Ultimately the central caseous part may be absorbed, and healing takes place with the development of a fibrous scar.

The arteritis will be considered in a separate section.

II. Acquired Syphilis.

Primary Stage.—This extends from the appearance of the initial sore until the onset of the constitutional symptoms, and has a variable duration of from six to twelve weeks. The initial sore appears within a month after inoculation, and it first shows itself as a small red papule, which gradually enlarges and breaks in the centre, leaving a small ulcer. The tissue about this becomes indurated so that it ultimately has a gristly, cartilaginous consistence—hence the name, hard or indurated chancre. The size attained is variable, and when small the sore may be overlooked, particularly if it is just within the urethra. The glands in the lymph-district of the chancre enlarge and become hard. Suppuration both in the initial lesion and in the glands may occur as a secondary change. The general condition of the patient in this stage is good. There may be no fever and no impairment of health.

Secondary Stage.—The first constitutional symptoms are usually manifested within three months of the appearance of the primary sore. They rarely develop earlier than the sixth or later than the twelfth week. The symptoms are: (*a*) *Fever*, slight or intense, and very variable in character. A mild continuous pyrexia is not uncommon, the temperature not rising above 101°. The fever may have a distinctly remittent character; but the most remarkable and puzzling type of syphilitic fever is the intermittent, which often leads to error in diagnosis. The fever may come on within a month after exposure and rise to 104° or 105°, with oscillations of five or six degrees (Yeo) A remarkable case is reported by Sidney Phillips, in which pyrexia persisted for months, with paroxysms resembling in all respects tertian ague, and which resisted quinine and yielded promptly to mercury and potassium iodide. Although usually a secondary manifestation, the fever of syphilis may occur late in the disease.

(*b*) *Anæmia.*—In many cases the syphilitic poison causes a pronounced anæmia which gives to the face a muddy pallor, and there may even be a light-yellow tingeing of the conjunctivæ or of the skin, an hæmatogenous icterus. This syphilitic cachexia may in some instances be extreme. The red blood-corpuscles do not show any special alterations. The blood-count may fall to three millions per cubic millimetre, or even lower, and the hæmoglobin to forty or fifty per cent (Hayem). No characteristic organisms have been found in the blood.

(*c*) *Cutaneous Lesions.*—Skin eruptions of all forms may develop. The earliest and most common is a rash—*macular syphilide* or *syphilitic roseola*—which occurs on the abdomen, the chest, and on the front of the arms. The face is often exempt. The spots, which are reddish-brown and symmetrically arranged, persist for a week or two. Next in frequency is a *papular syphilide*, which may form acne-like indurations about the face and trunk, often arranged in groups. Other forms are the *pustular rash*, which may so closely simulate variola that the patient may be sent to a small-pox hospital. A *squamous syphilide* occurs, not unlike ordinary psoriasis, except that the scales are less abundant. The rash is more copper-colored and not specially confined to the extensor surfaces.

In the moist regions of the skin, such as the perinæum and groins, the axillæ, between the toes, and at the angles of the mouth, the so-called *mucous patches* develop, which are flat, warty outgrowths, with well-defined margins and surfaces covered with a grayish secretion. They are among the most distinctive lesions of syphilis.

Frequently the hair falls out (alopecia), either in patches or by a general thinning. Occasionally the nails become affected (syphilitic onychia).

(*d*) *Mucous Lesions.*—With the fever and the roseolous rash the throat and mouth become sore. The pharyngeal mucosa is hyperæmic, the tonsils are swollen and often present small, kidney-shaped ulcers with grayish-white borders. Mucous patches are seen on the inner surfaces of the cheeks and on the tongue and lips. Sometimes on the tongue there are whitish spots (leucomata), which are seen most frequently in smokers, and which Hutchinson regards as the joint result of syphilitic glossitis and the irritation of hot tobacco-smoke. Hypertrophy of the papillæ in various portions of the mucous membrane produces the syphilitic warts or condylomata which are most frequent about the vulva and anus.

(*e*) *Other Lesions.*—*Iritis* is common, and usually affects one eye before the other. It develops in from three to six months after the chancre. There may be only slight ciliary congestion in mild cases, but in severer forms there is great pain, and the condition is serious and demands careful management. *Choroiditis* and *retinitis* are rare secondary symptoms. Ear affections are not common in the secondary stage, but instances are found in which sudden deafness develops, which may be due to labyrinthine disease; more commonly the impaired hearing is due to the extension

and parotitis are

in association with syphilis.

Para-syphilitic affections. Certain disorders which, while not actually syphilitic, are so closely connected, that a large proportion of the cases have had the disease are termed para-syphilitic (by Fournier (Les affections Parasyphilitiques - 1894). These affections are characters are distinctive ones caused by syphilis and while not exclusively & necessarily so, are not influenced by specific treatment. The chief of them are locomotor ataxia, dementia paralytica and certain types of epilepsy and, we may add, asteno-

of inflammation from the throat to the middle ear. Epididymitis is an occasional secondary lesion.

Tertiary Stage.—No hard and fast line can be drawn between the lesions of the secondary and those of the tertiary period; and, indeed, in exceptional cases, manifestations which usually appear late may set in even before the primary sore has properly healed. The special affections of this stage are certain skin eruptions, gummatous growths in the viscera, and amyloid degenerations.

(*a*) The late *syphilides* show a greater tendency to ulceration and destruction of the deeper layers of the skin, so that in healing scars are left. They are also more scattered and seldom symmetrical. One of the most characteristic of the tertiary syphilides is rupia, the dry stratified crusts of which cover an ulcer which involves the deeper layers of the skin and in healing leaves a scar.

(*b*) *Gummata.*—These may develop in the skin, subcutaneous tissue, muscles, or internal organs. The general character has been already described. When they develop in the skin they tend to break down and ulcerate, leaving ugly sores which heal with difficulty. In the solid organs they undergo fibroid transformation and produce puckering and deformity. On the mucous membranes these tertiary lesions lead to ulceration, in the healing of which cicatrices are formed; thus, in the larynx great narrowing may result, and in the rectum ulceration with fibroid thickening and retraction may lead to stricture.

(*c*) *Amyloid Degeneration.*—Syphilis plays a most important *rôle* in the production of this affection. Of 244 instances analyzed by Fagge, 76 had syphilis, and of these 42 had no bone lesions. It follows the acquired form and is very common in the rectal disease in women. In congenital lues amyloid degeneration is rare.

(*d*) *Sclerosis*—Syphilis is an important factor in inducing degenerative changes in certain tissues. In locomotor ataxia the association between this disease and sclerosis of the posterior columns of the cord is far too frequent to be accidental, but the precise relations cannot, with our present knowledge, be explained. With regard to arterio-sclerosis, the part played by syphilis is unquestioned, but the nature of the connection of the two processes remains doubtful.

III. Congenital Syphilis.

With the exception of the primary sore, every feature of the acquired disease may be seen in the congenital form.

The intra-uterine conditions leading to the death of the fœtus do not here concern us. The child may be born healthy-looking, or with well-marked evidences of the disease. In the majority of instances the former is the case, and within the first month or two the signs of the disease appear.

Symptoms.—(*a*) *At Birth.*—When the disease exists at birth the

child is feebly developed and wasted, and a skin eruption is usually present, commonly in the form of bullæ about the wrists and ankles, and on the hands and feet (pemphigus neonatorum). The child snuffles, the lips are ulcerated, the angles of the mouth fissured, and there is enlargement of the liver and spleen. The bone symptoms may be marked, and the epiphyses may even be separated. In such cases the children rarely survive long.

(*b*) *Early Manifestations.*—When born healthy the child thrives, is fat and plump, and shows no abnormity whatever; then from the fourth to the eighth week, rarely later, a nasal catarrh develops, *syphilitic rhinitis*, which impedes respiration, and produces the characteristic symptom which has given the name *snuffles* to the disease. The discharge may be sero-purulent or bloody. The child nurses with great difficulty. In severe cases ulceration takes place with necrosis of the bone, leading to a depression at the root of the nose and a deformity characteristic of congenital syphilis. This coryza may be mistaken at first for an ordinary catarrh, but the coexistence of other manifestations usually makes the diagnosis clear. The disease may extend into the Eustachian tubes and middle ear and lead to deafness.

The *cutaneous lesions* develop with or shortly after the onset of the snuffles. The skin often has a sallow, earthy hue. The eruptions are first noticed about the nates. There may be an erythema or an eczematous condition, but more commonly there are irregular reddish-brown patches with well-defined edges. A papular syphilide in this region is by no means uncommon. Fissures develop about the lips, either at the angles of the mouth or in the median line. These *rhagades*, as they are called, are very characteristic. There may be marked ulceration of the mucocutaneous surfaces. The secretions from these mouth lesions are very virulent, and it is from this source that the wet-nurse is usually infected. Not only the nurse, but members of the family, may be contaminated. There are instances in which other children have been accidentally inoculated from a syphilitic infant. The hair of the head or of the eyebrows may fall out. The syphilitic *onychia* is not uncommon. Enlargement of the glands is not so frequent in the congenital as in the acquired disease. When the cutaneous lesions are marked, the contiguous glands can usually be felt. As pointed out by Gee, the spleen is enlarged in many cases. The condition may persist for a long time. Enlargement of the liver, though often present, is less significant, since in infants it may be due to various causes. These are among the most constant symptoms of congenital syphilis, and usually develop between the third and twelfth weeks. Frequently they are preceded by a period of restlessness and wakefulness, particularly at night. Some authors have described a peculiar syphilitic cry, high-pitched and harsh. Among rarer manifestations are hæmorrhages—the *syphilis hæmorrhagica neonatorum*. The bleeding may be subcutaneous, from the mucous surfaces, or, when early, from the

umbilicus. All of such cases, however, are not syphilitic, and the disease ought not be confounded with the acute hæmoglobinuria of new-born infants, which Winckel describes as occurring in epidemic form, and which is probably an acute infectious disorder.

(c) *Late Manifestations.*—Children with congenital syphilis rarely thrive. Usually they present a wizened, wasted appearance, and a prematurely aged face. In the cases which recover, the general nutrition may remain good and the child may show no further manifestations of the disease; commonly, however, at the period of second dentition or at puberty the disease reappears. Although the child may have recovered from the early lesions, it does not develop like other children. Growth is slow, development tardy, and there are facial and cranial characteristics which often render the disease recognizable at a glance. A young man of sixteen or twenty may neither look older nor be more developed than a boy of ten or twelve. Fournier describes this condition as *infantilism*. The forehead is prominent, the frontal eminences are marked, and the skull may be very asymmetrical. The bridge of the nose is depressed, the *nares* are *retroussé*. The lips are often prominent, and there are striated scars running from the corners of the mouth. The *teeth* are deformed and may present appearances which Jonathan Hutchinson claims are specific and peculiar. The upper central incisors of the permanent set are the teeth which give information. The specific alterations are—the teeth are peg-shaped, stunted in length and breadth, and narrower at the cutting edge than at the root. On the anterior surface the enamel is well formed, and not eroded or honeycombed. At the cutting edge there is a single notch, usually shallow, sometimes deep, in which the dentine is exposed.

Among late manifestations, particularly apt to appear about puberty, is the interstitial *keratitis*, which usually begins as a slight steaminess of the corneæ, which present a ground-glass appearance. It affects both eyes, though one is attacked before the other. It may persist for months, and usually clears completely, though it may leave opacities, which prevent clear vision. *Iritis* may also occur. Of *ear affections*, apart from those which develop as a sequence of the pharyngeal disease, a form occurs about the time of puberty or earlier, in which deafness comes on rapidly and persists in spite of all treatment. It is unassociated with obvious lesions, and is probably labyrinthine in character. *Bone lesions*, occurring almost after the sixth year, are not rare among the late manifestations of hereditary syphilis. The tibiæ are most frequently attacked. It is really a chronic gummatous periostitis, which gradually leads to great thickening of the bone. The nodes of congenital syphilis, which are often mistaken for rickets, are more commonly diffuse and affect the bones of the upper extremities. They are generally symmetrical and rarely suppurate. They may develop late, even after the twenty-first year.

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(see p. 3)

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Joint lesions are rare. Clutton has described a symmetrical synovitis

of the knee in hereditary syphilis. Lastly, it must be borne in mind that enlargement of the spleen may be one of the late manifestations, and may occur either alone or in connection with disease of the liver. At the University Hospital, Philadelphia, I had under observation for more than a year a girl of thirteen, small and feebly developed, with a luetic facies, whose spleen reached as low as the level of the navel. The condition was not thought to be due to inherited syphilis until she developed osseous lesions.

Gummata of the liver, brain, and kidneys have been found in late hereditary syphilis.

IV. Visceral Syphilis.

A. **Syphilis of the Brain and Cord.**—The following lesions occur:

(1) *Gummata*, forming definite tumors, ranging in size from a pea to a walnut. They are usually multiple and attached to the pia mater, sometimes to the dura. Very rarely they are found unassociated with the meninges. When small they present a uniform, translucent appearance, but when large the centre undergoes a fibro-caseous change, while at the periphery there is a firm, translucent, grayish tissue. They may closely resemble large tuberculous tumors. The growths are most common in the cerebrum. They may be multiple and may even attain a considerable size without becoming caseous. Occasionally gummata undergo cystic degeneration. In the cord large gummatous growths are not so common. In an instance recently reported by me a tumor, from three eighths to one fourth of an inch in diameter, was completely within the cord opposite the fourth cervical nerve, and there were numerous gummata in the cauda equina.

(2) *Gummatous Meningitis.*—This constantly occurs in the neighborhood of the larger growths, and there may be local meningeal thickening several centimetres in extent, in which the pia is infiltrated and the arteries greatly thickened. This by no means uncommon form may run a subacute or a chronic course.

(3) *Gummatous Arteritis.*—The lesions may be confined to the arteries which present the nodular tumors to be described hereafter.

(4) Foci of *sclerosis*, which Lancereaux holds may be distinguished from non-specific forms by a much greater tendency of the neuroglia elements to undergo fatty transformation, and by the secondary alterations, as areas of softening, which occur in the neighborhood. Neither the diffuse nor the nodular cerebral sclerosis, met with particularly in children, appears to have any special relation to inherited syphilis.

(5) Whether a localized encephalitis or myelitis can result from the action of the syphilitic poison without involvement of the blood-vessels is doubtful. In a case of multiple arterial gummata recently in my ward, Thomas found in the lumbar region of the cord foci of inflammatory softening.

Sometimes with the lymphatic glands ~~in the case~~ chronic enlargement of the salivary glands may also occur.

Affections of the nervous system are evidently more
common in the secondary stage of syphilis than
has been found. The recent discussion at the
Royal Medical and Chirurgical Society (B.M.J. 1895.1)
and Lydston's paper (J. am. Med. Ass. 1895.1) show that
various affections of the nervous system are by no means
uncommon during the secondary stage of the disease

Secondary Changes.—In the brain gummatous arteritis is one of the common causes of softening, which may be extensive, as when the middle cerebral artery is involved, or when there is a large patch of syphilitic meningitis. In such instances the process is really a meningo-encephalitis, and the symptoms are due to the secondary changes in the brain-substance, not directly to the gumma. In the neighborhood of a gummatous growth intense encephalitis or myelitis may develop, and within a few days change the clinical picture. Gummatous arteritis may lead to weakening of the wall of the vessel and rupture with meningeal hæmorrhage.

Syphilitic disease of the nerve-centres may occur in the inherited or acquired form, most commonly in the latter. In the congenital cases the tumors usually develop early, but may be as late as the twenty-first year (H. C. Wood). In the acquired form the nerve lesions belong, as a rule, to the late manifestations, and patients may have quite forgotten the existence of a primary infection, and in very many instances the secondary manifestations have been slight. Heubner, to whom we owe so much in connection with this subject, has seen it as late as the thirtieth year. On the other hand, in exceptional instances, it may occur very early, and convulsions and brain symptoms have been reported within three months of the primary sore. In one of my cases, in which there was endarteritis followed by dilatation and perforation, the patient had had a hard chancre eighteen months before, with severe secondary symptoms.

Symptoms.—The chief features of cerebral syphilis are those of tumor, which will be considered subsequently under that section. They may be classified here as follows:

(1) Psychical features. A sudden and violent onset of delirium may be the first symptom. In other instances prior to the occurrence of delirium there have been headache, alteration of character, and loss of memory. The condition may be accompanied by convulsions. There may be no neuritis, no palsy, and no localizing symptoms.

(2) More commonly following headache, giddiness, or an excited state which may amount to delirium, the patient has an epileptic seizure or develops hemiplegia, or there is involvement of the nerves of the base. Some of these cases display a prolonged torpor, a special feature of brain syphilis to which both Buzzard and Heubner have referred, which may persist for as long as a month. H. C. Wood describes with this a state of automatism occurring particularly at night, in which the patient behaves like "a restless nocturnal automaton rather than a man."

(3) A clinical picture of general paralysis—dementia paralytica. The question is still in dispute whether this syphilitic encephalopathy, which so closely resembles general paralysis, is a distinct and independent affection. Mickle, who has carefully reviewed the subject, concludes that syphilis may directly produce the inflammatory changes in the brain, while in other instances it directly predisposes to this affection. It is a somewhat remarkable feature that the cases which present the clinical picture

of general paresis are most frequently those which have not had any focalizing symptoms, and they may not have convulsions until the disease is well advanced. Another peculiarity is the fact that, like the late sclerosis, the condition is not very amenable to the specific treatment; though Mitchell mentions an instance which he regarded as general paresis, but which subsequently came into the hands of H. C. Wood, who cured the case with iodide of potassium.

(4) Many cases of cerebral syphilis display the symptoms of brain tumor—headache, optic neuritis, vomiting, and convulsions. Of these symptoms convulsions are the most important, and both Fournier and Wood have laid great stress on the value of this symptom in persons over thirty. The first symptoms may, however, rather resemble embolism or thrombosis; thus there may be sudden hemiplegia, with or without loss of consciousness.

The symptoms of *spinal syphilis* are extremely varied and may be caused either by large gummatous growths attached to the meninges, in which case the features are those of tumor; or by meningitis with secondary spastic changes; or again by scleroses developing late in the disease, the relation of which to syphilis is still obscure.

Diagnosis.—The history is of the first importance, but it may be extremely difficult to get a reliable account. Careful examination should be made for traces of the primary sore, for the cicatrices of bubo, for scars of the skin eruption or throat ulcers, and for bone lesions. The character of the symptoms is often of great assistance. They are multiform, variable, and often such as could not be explained by a single lesion; thus there may be anomalous spinal symptoms or involvement of the nerves of the brain on both sides. And lastly the result of treatment has a definite bearing on the diagnosis, as the symptoms may clear up and disappear with the use of antisyphilitic remedies.

B. **Syphilis of the Lung.**

This is a very rare disease. During twenty years I have not seen more than half a dozen specimens in which there was no question as to the nature of the trouble. Early in my professional life I learned to recognize the disease from the teaching of Wilks, and became familiar with the excellent specimens preserved at Guy's Hospital. In my ten years' work in Montreal not a single specimen was recognized at the dissections at the General Hospital. In 1878 and 1884 I saw several characteristic examples in London and Germany. During five years in Philadelphia, for the greater part of which time I was connected with the Philadelphia Hospital, which has perhaps as rich luetic material as is to be found anywhere, only one or two specimens were seen. Three admirable illustrations of pulmonary gummata have occurred at the Johns Hopkins Hospital during the past two years. I mention these details because the subject is one which has always interested me, and I have been constantly on the lookout for the disease. It has been a continual surprise that it should be so com-

mon in certain localities, but I find that my experience as to its comparative rarity tallies very closely with that of pathologists and hospital physicians in this country and in Europe. The literature of the subject is extensive, but from the clinical aspect largely worthless, as it preceded Koch's discovery of the *bacillus tuberculosis*.

Etiology and Morbid Anatomy.—Syphilis of the lung occurs under the following forms:

(1) The *white pneumonia of the fœtus*. This may affect large areas or an entire lung, which then is firm, heavy and airless, even though the child may have been born alive. On section it has a grayish-white appearance—the so-called white hepatization of Virchow. The chief change is in the alveolar walls, which are greatly thickened and infiltrated, so that, as Wagner expressed it, the condition resembles a diffuse syphiloma. In the early stages, for example, in a seven or eight months' fœtus, there may be scattered miliary foci of this induration chiefly about the arteries. The air-cells are filled with desquamated and swollen epithelium.

(2) In the form of definite *gummata*, which vary in size from a pea to a goose-egg. They occur irregularly scattered through the lung, but, as a rule, are more numerous toward the root. They present a grayish-yellow caseous appearance, are dry and usually imbedded in a translucent, more or less firm, connective tissue. In a case from my wards recently described by Councilman, there was extensive involvement of the root of the lungs. Bands of connective tissue passed inward from the thickened pleura and between these strands and surrounding the gummata there was in places a mottled red pneumonic consolidation. In the caseous nodules there is typical hyaline degeneration. Councilman describes as the primary lesion, atrophy of the alveolar walls with hyaline degeneration of the capillaries, not the syphilitic endarteritis, which is well marked, and to which the lesions are attributed. The bronchi are usually involved, and surrounding the gummata there may be a diffuse broncho-pneumonia, which does not appear to have any peculiar characters.

(3) A majority of authors follow Virchow in recognizing the fibrous interstitial pneumonia at the root of the lung and passing along the bronchi and vessels as probably syphilitic. This much may be said, that in certain cases gummata are associated with these fibroid changes. Again, this condition alone is found in persons with well-marked syphilitic history or with other visceral lesions. It seems in many instances to be a purely sclerotic process, advancing sometimes from the pleura, more commonly from the root of the lung, and invading the interlobular tissue, gradually producing a more or less extensive fibroid change. It rarely involves more than a portion of a lobe or portions of the lobes at the root of the lung. The bronchi are often dilated.

Symptoms.—Is there a syphilitic phthisis, an ulcerative and destructive disease, due to lues? Personally I have no knowledge of such an affection, either clinically or anatomically, and the cases which I have seen

demonstrated do not seem to me to have characters distinctive enough to separate them from ordinary tuberculous phthisis. Certain French writers recognize not only a chronic syphilitic phthisis but an acute syphilitic pneumonia in adults, simulating acute pneumonic phthisis. Clinically, pulmonary syphilis is not of much importance, as the cases can rarely be diagnosed, and the symptoms which arise are usually those of bronchiectasis or of chronic interstitial pneumonia. The white pneumonia is usually found in the still-born.

Diagnosis.—It is to be borne in mind, in the first place, that hospital physicians and pathologists the world over bear witness to the extreme rarity of lung syphilis. In the second place, the therapeutic test upon which so much reliance is placed is by no means conclusive. With pulmonary tuberculosis there should now be no confusion, owing to the readiness with which the presence of bacilli is determined. Bronchiectasy in the lower lobe of a lung, dependent upon an interstitial pneumonia of syphilitic origin, could not be distinguished from any other form of the disease. In persons with well-marked syphilitic lesions elsewhere, when obscure pulmonary symptoms occur, or if there are signs of chronic interstitial pneumonia with dilated bronchi, and no tubercle bacilli are present, the condition may possibly be due to syphilis. So far as my experience goes, tuberculous phthisis occurring in a syphilitic subject has no special peculiarities. The lesions of syphilis and tuberculosis could of course coexist in a lung. Since writing the above, the recent paper of Satterthwaite has appeared, but not one of the cases upon which it is based could properly be regarded as syphilitic in the absence of an examination for tubercle bacilli. Much more suggestive of true syphilitic phthisis is Case I of McLane Tiffany's series, but it too may have been tuberculous. It is quite possible that a large caseous gumma may break down and form a cavity, but the existence of an extensive ulcerative and destructive disease of the lungs (comparable to tuberculosis) due to syphilis has not yet been proved.

c. **Syphilis of the Liver.**

This occurs in three forms: (*a*) *Diffuse Syphilitic Hepatitis.*—This is most common in cases of congenital syphilis. The liver preserves its form, is large, hard, and resistant. Sometimes it has a yellow look, compared by Trousseau to sole-leather, or an appearance not unlike the amyloid liver. Careful inspection shows grayish or whitish points and lines corresponding to the interlobular new growth. Microscopically, great increase in the connective tissue is seen, and in many places foci of small-celled infiltration. Sometimes these nodules are visible, forming firm miliary gummata which in cicatrizing produce more or less deformity. Larger gummata may also be present.

(*b*) *Gummata.*—As a result of congenital syphilis these may occur in childhood or in adult life. In acquired syphilis they rarely come on before the second year after infection. In the early stage there are pale

grayish nodules, varying in size from a pea to a marble. The larger, which are usually limited toward the liver tissue, present yellowish centres at first; but later there is a "pale yellowish, cheese-like nodule of irregular outline, surrounded by a fibrous zone, the outer edge of which loses itself in the lobular tissue, the lobules dwindling gradually in its grasp. This fibrous zone is never very broad; the cheesy centre varies in consistence from a gristle-like toughness to a pulpy softness; it is sometimes mortar-like, from cretaceous change" (Wilks). When numerous, the most extensive deformity of the liver is produced in the gradual healing of these gummata. On the surface there are deep, scar-like depressions, and the entire organ may be divided into a cluster of irregular masses, held together by fibrous tissue. To this condition the term *botryoid* has been given, from its resemblance to a bunch of grapes. As a rule, the gummata gradually undergo fibroid transformation. They may, however, soften and liquefy, and, according to Wilks, may form a fluctuating tumor.

(*c*) Occasionally the syphilitic changes are chiefly manifested in *Glisson's sheath*, in a thickening of the capsule, producing peri-hepatitis, and increase in the connective tissue in the *portal canals*, so that on section the organ presents a number of branching fibrous scars which may cause considerable deformity.

Symptoms.—The symptoms of syphilitic hepatitis are very variable. In the new-born icterus is not uncommon, but the condition of the liver can scarcely be recognized. In the adult there are two groups of cases:

The patient presents a picture of cirrhosis of the liver; there are digestive disturbances, slight icterus, loss of weight, and ascites. If signs of syphilis are present in other organs, the condition may be suspected, or if after removal of the fluid the liver is felt to be extremely irregular, the diagnosis may be made almost with certainty. As these cases, with proper treatment, may recover, they form a certain contingent of the cases reported as recovery in ordinary cirrhosis of the liver.

In a second group of cases the patient is anæmic, passes large quantities of pale urine containing albumen and tube-casts; the liver is enlarged, perhaps irregular, and the spleen also is enlarged. Dropsical symptoms may supervene, or the patient may be carried off by some intercurrent disease. Extensive amyloid degeneration of the spleen, the intestinal mucosa, and of the liver, with gummata, are found.

The *diagnosis* of syphilis of the liver is very important, since upon it the proper treatment depends. If with a history of infection the liver is enlarged and irregular, and the general health fairly good, the condition is probably syphiloma. Occasionally tumors of a definite form may be produced by the gummata. For two years I showed repeatedly, at my clinic at the University Hospital, Philadelphia, a boy aged eleven, who had a prominent tumor in the epigastrium connected with the liver, the nature of which was obscure until well-marked bone-lesions developed.

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In another case, a man, aged thirty, was sent to me for advice concerning the making of an exploratory incision to determine the nature of a firm, irregular tumor which occupied the epigastric region, and was evidently connected with the left lobe of the liver. It had lasted for more than a year, had increased slightly, and had not impaired, to any marked degree, the general health. This fact, together with a well-marked history of acquired syphilis, led me to place him upon a rigid antisyphilitic treatment, with the result that within six months the entire tumor disappeared.

D. **Syphilis of the Digestive Tract.**

The *œsophagus* is very rarely affected. Stenosis is the usual result. Gummata of the *stomach* occur occasionally. Syphilitic ulceration has been found in the stomach, in the small intestine, and in the cæcum.

The most common seat of syphilitic disease in this tract is the *rectum*. The affection is found most commonly in women, and results from the development of gummata in the submucosa above the internal sphincter. The process is slow and tedious, and may last for years before it finally induces stricture. The symptoms are usually those of narrowing of the lower bowel. The condition is readily recognized by rectal examination. The history of gradual on-coming stricture, the state of the patient, and the fact that there is a hard, fibrous narrowing, not an elevated crater-like ulcer, usually render easy the diagnosis from malignant disease. In medical practice these cases come under observation for other symptoms, particularly amyloid degeneration; and the rectal disease may be entirely overlooked, and only discovered post mortem.

E. **Circulatory System.**

Syphilis of the Heart.—A fresh, warty endocarditis due to syphilis is not recognized, though occasionally in persons dead of the disease this form is present, as is not uncommon in conditions of debility. Outgrowths on the valves in connection with gummata have been reported by Janeway and others, and in Lang's* monograph there are thirteen cases which he reports as syphilitic endocarditis, most of them of the fibrous or sclerotic variety.

Syphilitic myocarditis appears either in the form of diffuse fibroid induration or as definite gummata. Lang has collected many cases from the literature, a majority of which were of the former description. Gummata, however, occur not infrequently as definite and characteristic tumors in the myocardium. Rupture may take place, as in the cases reported by Dandridge and Nalty, or sudden death, as in the cases of Cayley and Pearce Gould.

Syphilis of the Arteries.—Syphilis is believed to play an important *rôle* in arterio-sclerosis and aneurism. Its connection with these processes will be considered later; here we shall refer only to the syphilitic arteritis. This occurs in two forms:

* Die Syphilis des Herzens, Wien, 1889.

(*a*) An *obliterating endarteritis*, characterized by a proliferation of the subendothelial tissue. The new growth lies within the elastic lamina, and may gradually fill the entire lumen; hence the term obliterating. The media and adventitia are also infiltrated with small cells. This form of endarteritis described by Heubner is not, however, characteristic of syphilis, and its presence alone in an artery could not be considered pathognomonic. If, however, there are gummata in other parts, or if the condition about to be described exists in adjacent arteries, the process may be regarded as syphilitic.

(*b*) *Gummatous Peri-arteritis.*—With or without involvement of the intima, nodular gummata may develop in the adventitia of the artery, producing globular or ovoid swellings, which may attain considerable size. They are not infrequently seen in the cerebral arteries, which seem to be specially prone to this affection. This form is specific and distinctive of syphilis. The disease usually affects the smaller vessels and may be found in the coronary arteries, and particularly in those of the brain.

F. **Renal Syphilis.**—Gummata occasionally develop in the kidneys, particularly in cases in which there is extensive gummatous hepatitis. They are rarely numerous, and occasionally lead to scattered cicatrices. Clinically the affection is not recognizable.

G. **Syphilitic Orchitis.**—This affection is of special significance to the physician, as its detection frequently clinches the diagnosis in obscure internal disorders. Syphilis occurs in the testes in two forms:

(*a*) The *gummatous growth*, forming an indurated mass or group of masses in the substance of the organ, and sometimes difficult to distinguish from tuberculous disease. The area of induration is harder and it affects the body of the testes, while tubercle more commonly involves the epididymis. It rarely tends to invade the skin, or to break down, soften, and suppurate, and is usually painless.

(*b*) There is an *interstitial orchitis* regarded as syphilitic, which leads to fibroid induration of the gland and gradually to atrophy. It is a slow, progressive change, coming on without pain, usually involving one organ more than another.

General Diagnosis of Syphilis.—There is seldom any doubt concerning the existence of syphilitic lesions. The negative statements of the patient must be taken with extreme caution, as persons will lie deliberately with reference to primary infection, when it is in their best interest to make a straightforward truthful statement. It is to be remembered that syphilis is common in the community, and there are probably more families with a luetic than with a tuberculous taint. It is possible that the primary sore may have been of trifling extent, or urethral and masked by a gonorrhœa, and the patient may not have had severe secondary symptoms, but such instances are extremely rare. Inquiries should be made into the history to ascertain if the patient has had skin rashes, sore throat, or if the hair has fallen out. Careful inspection should

be made of the throat and skin for signs of old lesions. Scars in the groins, the result of buboes, may be taken as positive evidence of infection (Hutchinson). The cicatrices on the legs are often copper-colored, though this cannot be regarded as peculiar to syphilis. The bones should be examined for nodes. In doubtful cases the scar of the primary sore may be found, or there may be signs of atrophy or of hardening of the testes. In women, special stress has been laid upon the occurrence of frequent miscarriages, which, in connection with other circumstances, are always suggestive.

In the congenital disease, the occurrence within the first three months of snuffles and skin rashes is conclusive. Later, the characters of the syphilitic facies, already referred to, often give a clew to the nature of some obscure visceral lesion. Other distinctive features are the symmetrical development of nodes on the bones and the interstitial keratitis.

In doubtful cases much stress is laid by some writers upon the therapeutic test, by placing the patient upon antisyphilitic treatment. In the case of an obstinate skin rash of doubtful character, which has resisted all other forms of medication, this has much greater weight than in obscure visceral lesions. I have on several occasions known such marked improvement to follow large doses of iodide of potassium that the diagnosis of syphilitic lesion was greatly strengthened, but the subsequent course and the post-mortem have shown that the disease was not syphilis.

Prophylaxis.—Irregular intercourse has existed from the beginning of recorded history, and unless man's nature wholly changes—and of this we can have no hope—will continue. Resisting all attempts at solution, the social evil remains the great blot upon our civilization, and inextricably blended with it is the question of the prevention of syphilis. Two measures are available—the one personal, the other administrative.

Personal purity is the prophylaxis which we, as physicians, are especially bound to advocate. Continence may be a hard condition (to some harder than to others), but it can be borne, and it is our duty to urge this lesson upon young and old who seek our advice in matters sexual. Certainly it is better, as St. Paul says, to marry than to burn, but if the former is not feasible there are other altars than those of Venus upon which a young man may light fires. He may practise at least two of the five means by which, as the physician Rondibilis counselled Panurge, carnal concupiscence may be cooled and quelled—hard work of body and hard work of mind. Idleness is the mother of lechery; and a young man will find that absorption in any pursuit will do much to cool passions which, though natural and proper, cannot in the exigencies of our civilization always obtain natural and proper gratification.

The second measure is a rigid and systematic regulation of prostitution. The state accepts the responsibility of guarding citizens against small-pox or cholera, but in dealing with syphilis the problem has been

too complex and has hitherto baffled solution. On the one hand, inspection, segregation, and regulation are difficult if not impossible to carry out; on the other hand, public sentiment, in Anglo-Saxon communities at least, is as yet bitterly opposed to this plan. While this feeling, though unreasonable, as I think, is entitled to consideration, the choice lies between two evils—licensing, even imperfectly carried out, or wide-spread disease and misery. If the offender bore the cross alone, I would say, forbear; but the physician behind the scenes knows that in countless instances syphilis has wrought havoc among innocent mothers and helpless infants, often entailing life-long suffering. It is for them he advocates protective measures.

Treatment.—We must admit that various organizations react very differently to the poison of syphilis. There are individuals who, although receiving brief and unsatisfactory treatment, display for years no traces of the disease. On the other hand, there are persons thoroughly and systematically treated from the outset who display from time to time well-marked indications of the disease. Certainly there are grounds for the opinion that persons who have suffered very slightly from secondary symptoms are more prone to have the severer visceral lesions of the later stage.

When we consider that syphilis is one of the most amenable of all diseases to treatment, it is lamentable that the later stages which come under the charge of the physician are so common. This results, in great part, from carelessness of the patient, who, wearied with treatment, cannot understand why he should continue to take medicine after all the symptoms have disappeared; but, in part, the profession also is to blame for not insisting more urgently in every instance that acquired syphilis is not cured in a few months, but takes at least two years, during which time the patient should be under careful supervision. The treatment of the disease is now practically narrowed to the use of two remedies, justly termed specifics—namely, mercury and iodide of potassium. The former is of special service in the secondary, the latter in the tertiary manifestations of the disease; but they are often combined with advantage.

Mercury may be given by the mouth in the form of gray powder, the hydrargyrum cum cretâ, which Hutchinson recommends to be given in pills, one-grain dose with a grain of Dover's powder. One pill from four to six times a day will usually suffice. I warmly endorse the excellent results which are obtained by this method, under which the patient often gains rapidly in weight, and the general health improves remarkably. It may be continued for months without any ill effects. Other forms given by the mouth are the pilules of the biniodide (gr. $\frac{1}{16}$), or of the protiodide (gr. $\frac{1}{8}$), three times a day.

Inunction is a still more effective means. A drachm of the ordinary mercurial ointment is thoroughly rubbed into the skin every evening for six days; on the seventh a warm bath is taken, and on the eighth the mer-

curial course is resumed. At least half an hour should be given to each inunction. It is well to apply it at different places on successive days. The sides of the chest and abdomen and the inner surfaces of the arms and thighs are the best positions.

The mercury may be given by direct injection into the muscles. If proper precautions are taken in sterilizing the syringe, and if the injections are made into the muscles, not into the subcutaneous tissue, abscesses rarely result. One third of a grain of the bichloride in twenty drops of water may be injected once a week, or from one to two grains of calomel in glycerin (20 minims).

Still another method, greatly in vogue in certain parts of the Continent and in institutions, is fumigation. It may be carried out effectively by means of Lee's lamp. The patient sits on a chair wrapped in blankets, with the head exposed. The calomel is volatilized and deposited with the vapor on the patient's skin. The process lasts about twenty minutes, and the patient goes to bed wrapped in blankets without washing or drying the skin. A patient under mercurial treatment should avoid stimulants and live a regular life, not necessarily abstaining from business. Green vegetables and fruit should not be taken. Salivation is to be avoided. The teeth should be cleansed twice a day, and if the gums become tender, the breath fetid, or the tongue swollen and indented, the drug should be suspended for a week or ten days.

In congenital syphilis the treatment of cases born with bullæ and other signs of the disease is not satisfactory, and the infants usually die within a few days or weeks. The child should be nursed by the mother alone, or, if this is not feasible, should be hand-fed, but under no circumstances should a wet-nurse be employed. The child is most rapidly and thoroughly brought under the influence of the drug by inunction. The mercurial ointment may be smeared on the flannel roller. This is not a very cleanly method, and sometimes rouses the suspicion of the mother. It is preferable to give the drug by the mouth, in the form of gray powder, half a grain three times a day. In the late manifestations associated with bone lesions, the combination of mercury and iodide of potassium is most suitable and is well given in the form of Gilbert's syrup, which consists of the biniodide of mercury (gr. j), of potassium iodide (℥ ss.), and water (℥ ij). Of this a dose for a child under three is from five to ten drops three times a day, gradually increased. Under these measures, the cases of congenital syphilis usually improve with great rapidity. The medication should be continued at intervals for many months, and it is well to watch these patients carefully during the period of second dentition and at puberty, and if necessary to place them on specific treatment.

In the treatment of the visceral lesions of syphilis, which come more distinctly within the province of the physician, iodide of potassium is of equal or even greater value than mercury. Under its use ulcers rapidly heal, gummatous tumors melt away, and we have an illustration of a spe-

cific action only equalled by that of mercury in the secondary stages, by iron in certain forms of anæmia, and by quinine in malaria. It is as a rule well borne in an initial dose of ten grains, or ten minims of the saturated solution; given in milk the patient does not notice the taste. It should be gradually increased to thirty or more grains three times a day. In syphilis of the nervous system it may be used in still larger doses. Seguin, who has specially insisted upon the advantage of this plan, urges that the drug should be pushed, as good effects are not obtained with the moderate doses.

When syphilitic hepatitis is suspected the combination of mercury and iodide of potassium is most satisfactory. If there is ascites, Addison's or Plummeyer's pill (as it is often called) of calomel, digitalis, and squills will be found very useful. A patient of mine with recurring ascites, on whom paracentesis was repeatedly performed and who had an enlarged and irregular liver, took this pill for more than a year with occasional intermissions, and ultimately there was a complete disappearance of the dropsy and an extraordinary reduction in the volume of the liver. Occasionally the iodide of sodium is more satisfactory than the iodide of potassium. It is less depressing and agrees better with the stomach. Many patients possess a remarkable idiosyncrasy to the iodide, but as a rule it is well borne. Severe coryza with salivation, and œdema about the eyelids, are its most common disagreeable effects. Skin eruptions also are frequent. I have known patients unable to take more than from twenty to thirty grains without suffering from an erythematous rash; much more common is the acne eruption. Occasionally an urticarial rash may develop with spots of purpura. Some of these iodide eruptions may closely resemble syphilis. Hutchinson has reported instances in which they have proved fatal.

Upon the question of syphilis and marriage the family physician is often called to decide. He should insist upon the necessity of two full years elapsing between the date of infection and the contracting of marriage. This, it should be borne in mind, is the earliest possible limit, and there should be at least a year of complete immunity from all manifestations of the disease.

In relation to life insurance, an individual with syphilis can not be regarded as a first-class risk unless he can furnish evidence of prolonged and thorough treatment and of immunity for two or three years from all manifestations. Even then, when we consider the extraordinary frequency of the cerebral and other complications in persons who have had this disease and who may even have undergone thorough treatment, the risk to the company is certainly increased.

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XXVI. TUBERCULOSIS.

I. General Etiology and Morbid Anatomy.

Definition.—An infective disease, caused by the *bacillus tuberculosis*, the lesions of which are characterized by nodular bodies called tubercles or diffuse infiltrations of tuberculous tissue which undergo caseation or sclerosis and may finally ulcerate, or in some situations calcify.

Etiology.—1. **Zoölogical Distribution.**—Tuberculosis is one of the most wide-spread of maladies.

In cold-blooded animals it is rare, owing doubtless to temperature conditions unfavorable to the development of the bacillus. Among reptiles in confinement it is, however, occasionally seen (Sibley). In fowls it is an extremely common disease, but recent facts indicate that there are differences in avian tuberculosis sufficient to warrant its separation from the ordinary form.

Among domestic animals tuberculosis is widely but unevenly distributed. Among ruminants, bovines are chiefly affected. The statistics of the Berlin abattoir show that in the years 1887–'88 tuberculosis was found in 4,300 cattle. In this country it is extremely difficult to get satisfactory statistics of the prevalence of the disease. At the meeting of the United States Veterinary Medical Association in 1889, it was stated in a resolution that from ten to fifteen per cent of the dairy stock of the Eastern States was tuberculous.

In Baltimore, A. W. Clement, United States veterinary inspector, informs me that of 5,297 cattle slaughtered in Maryland only 159 were tuberculous.

In sheep the disease is very rare. In pigs it is common, but not so common in this country as in Europe. In the inspection of one thousand hogs, which was made by A. W. Clement and myself in Montreal in 1880, tuberculosis was seen only once or twice. At the Berlin abattoir in 1887–'88 there were 6,393 pigs affected with the disease.

Horses are rarely attacked. Dogs and cats are not prone to the disease, but cases are described in which infection of pet animals has taken place from phthisical masters. Among the semi-domestic animals, such as the rabbit and guinea-pig, the disease under natural conditions is rare, although these animals, particularly the latter, are extremely susceptible to the disease when inoculated. Among apes and monkeys in the wild state, tuberculosis is unknown, but in confinement it is the most formidable disease with which they have to contend.

The important etiological fact in connection with tuberculosis in animals is the wide-spread occurrence of the disease in bovines, from which class we derive nearly all the milk and a very large proportion of the meat used for food.

2. **Geographical Distribution.**—The disease exists in all countries. It

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Definition.—An infective disease, caused by the *bacillus tuberculosis*, the lesions of which are characterised by nodular bodies called tubercles or diffuse infiltrations of tuberculous tissue which undergo caseation or sclerosis and may finally ulcerate, or in some situations calcify.

Etiology.—1. Zoological Distribution.—Tuberculosis is one of the most wide-spread of maladies.

In cold-blooded animals it is rare, owing doubtless to temperature conditions unfavorable to the development of the bacillus. Among reptiles in confinement it is, however, occasionally seen (Sibley).

In fowl it is an extremely common disease, but recent facts indicate that there are differences in avian tuberculosis sufficient to warrant its separation from the ordinary form.

Among domestic animals tuberculosis is widely but unevenly distributed. Among ruminants, bovines are chiefly affected. The statistics of the Boston abattoir show that in the years 1887-'88 tuberculosis was found in 4 per cent. In this country it is extremely difficult to get satisfactory statistics of the prevalence of the disease. At the meeting of the United States Veterinary Medical Association in 1886, it was stated in a resolution that from ten to fifteen per cent of the dairy stock of the Eastern States was tuberculous.

In Baltimore, A. W. Clement, United States veterinary inspector, informs me that of 5,227 cattle slaughtered in Maryland only 150 were tuberculous.

In sheep the disease is very rare. In pigs it is common, but not so common in this country as in Europe. In the inspection of one thousand hogs, which was made by A. W. Clement and myself in Montreal in 1887, tuberculosis was seen only once or twice. At the Berlin abattoir in 1887-'88 there were 4,561 pigs affected with the disease.

Horses are rarely attacked. Dogs and cats are not prone to the disease, but cases are described in which infection of pet animals has taken place from phthisical masters. Among the semi-domestic animals, rodents, the rabbit and guinea-pig, the disease under natural conditions is rare, although these animals, particularly the latter, are extremely susceptible to the disease when inoculated. Among apes and monkeys in the wild state, tuberculosis is unknown, but in confinement it is the most formidable disease with which they have to contend.

The important etiological fact in connection with tuberculosis in animals is the wide-spread occurrence of the disease in bovines, from which class we derive nearly all the milk and a very large proportion of the meat used for food.

2. Geographical Distribution.—The disease exists in all countries in

prevails more in the large cities and wherever the population is massed together. Thus, while the general death-rate from it is three per thousand, that of Vienna is 7·7, and of Munich and Glasgow four per thousand. Hirsch, from whose classical work these facts are taken, thinks that geographical position has less influence than has been supposed. Italy and England suffer alike, and the disease is very prevalent in the West Indies and the South Sea islands. Toward the poles it is rare. It is a common disease in Canada, and prevails extensively among the French Canadians and the English. Altitude is a more potent factor than latitude. In the high regions of the Alps and Andes, and in the central plateau of Mexico the disease is very rare. Mountainous countries, such as Switzerland, have a very low death-rate from tuberculosis.

3. **Race.**—No race is immune. The Indians of this continent are very prone to the disease. Matthews, whose experience with the native race is large, states that the disease is on the increase among them. He quotes the ratio from the United States census, 1880, as white 166, negroes 186, Indians 286. The death-rate in the older reservations, as in New York, is three times as great as in Dakota. In the Blood Indian Reserve of the Canadian Northwest Territories, Surgeon Kennedy (N. W. M. P.) has given me the figures for six years. In a population of about 2,000 there were 127 deaths from pulmonary consumption, twenty-three per cent of the total rate. This does not include deaths from "diseases of infancy." This enormous death-rate, it is to be remembered, occurs in a tribe occupying one of the finest climates of the world among the foot-hills of the Rocky Mountains, a region in which consumption is extremely rare among the white population, and in which cases of tuberculosis from the eastern provinces do remarkably well.

The negro race is very susceptible to tuberculosis, more particularly the glandular and osseous forms. Of the 427 cases of pulmonary tuberculosis at the Johns Hopkins Hospital for the two years ending June 1, 1891, there were 41 cases in the colored—i. e., about 1:10. The ratio of colored to white of all patients in the wards has been 1 to 7.

4. **The Bacillus Tuberculosis.**—The history of the discovery of the bacillus presents many points of interest. Confidently expected by such observers as Villemin, Chauveau, Cohnheim, and others, and claimed to have been demonstrated by many, notably by Klebs and Aufrecht, it remained for Koch to demonstrate its existence and its invariable association with the disease. The investigations which he had previously made upon anthrax and experimental traumatic infections, by perfecting the methods of research, paved the way for this brilliant discovery. His preliminary article * and his more elaborate later work † should be carefully studied by any one who wishes to appreciate the value of scientific methods. It forms

* Berliner klinische Wochenschrift, 1882.

† Mittheilungen a. d. k. Gesundheitsamte, Bd. 2.

one of the most masterly demonstrations of modern medicine. Its thoroughness appears in the fact that in the nine years which have elapsed since its announcement the innumerable workers at the subject have not, so far as I know, added a solitary essential fact to those presented by Koch.

Morphological Characters.—The tubercle bacillus is a short, fine rod, often slightly bent or curved, and has an average length of nearly half the diameter of a red blood-corpuscle (3 to 4 μ). When stained it often presents a beaded appearance, which some have attributed to the presence of spores.

With the basic aniline dyes it stains slowly, except at the body temperature, but retains the dye after treatment with acids—a characteristic which separates it from all other known forms of bacteria, with the exception of the bacillus of leprosy.

Modes of Growth.—It grows on blood-serum, glycerin-agar, or on potato—most readily on the former. The cultures must be kept at blood-heat. They grow slowly, and do not appear until about the end of the second week. The colonies form thin, grayish-white, dry, scale-like masses on the surface of the culture medium. Successive inoculations may be made from the cultures, and at the end of an indefinite series material from one of them inoculated into a guinea-pig will produce tuberculosis.

Products of the Growth.—Little is yet known of the chemical characters of the materials which result from the growth of the tubercle bacilli. Koch's tuberculin is stated to be a glycerin extract of the cultures. Crookshank and Herroun have separated an albumose and a ptomaine.

Distribution of the Bacilli.—The bacilli are found in all tuberculous lesions; in some in great abundance, in others sparsely. They are particularly numerous in actively developing tubercles, but in the chronic tuberculous processes of lymph-glands and of the joints they are scanty. When a tuberculous focus communicates with a vein or with lymph-vessels, the bacilli may be spread widely throughout the body. In old lesions they may not be found in the sections, and the demonstration of the true nature may be possible only by culture or inoculation.

The Bacilli outside the Body.—Patients with advanced pulmonary tuberculosis throw off in the expectoration countless millions of the bacilli daily. Some idea of the extraordinary numbers may be gained from the studies of Nuttall.* From a patient in my ward, with moderately advanced disease, the amount of whose expectoration was from seventy to a hundred and thirty cubic centimetres daily, he estimated by his method that there were in sixteen counts, between January 10th and March 1st, from one and a half to four and a third billions of bacilli thrown off in the twenty-four hours. These figures emphasize the danger associated with phthisical sputa unless most carefully dealt with. When expectorated and allowed to dry, the sputum rapidly becomes dust, and is distributed far and wide.

* Johns Hopkins Hospital Bulletin, May, 1891.

The observations made by Cornet under Koch's supervision are in this connection most instructive. He collected the dust from the walls and bedsteads of various localities, and determined its virulence or innocuousness by inoculation into susceptible animals. Material was gathered from twenty-one wards of seven hospitals, three asylums, two prisons, from the surroundings of sixty-two phthisical patients in private practice, and from twenty-nine other localities in which tuberculous patients were only transient frequenters (out-patient departments, streets, etc.). Of one hundred and eighteen dust samples from hospital wards or the rooms of phthisical patients, forty were infective and produced tuberculosis. Negative results were obtained with the twenty-nine dust samples from the localities occasionally occupied by consumptives. Virulent bacilli were obtained from the dust of the walls of fifteen out of twenty-one medical wards. It is interesting to note that in two wards with many phthisical patients the results were negative, indicating that the dust in such regions is not necessarily infective. The infectiousness of the medical and surgical divisions of a hospital is in the proportion of 76·6 to 12·5. In a room in which a tuberculous woman had lived, the dust from the wall in the neighborhood of the bed was infective six weeks after her death. No bacilli were found in the dust of an inhalation-chamber for consumptives.

The tubercle bacillus is thus a wide-spread organism in regions frequented by phthisical patients.

5. **Modes of Infection.**—(*a*) *Hereditary Transmission.*—In extremely rare instances the disease is congenital. A few undoubted cases have been reported in man and in the calf. The rarity with which it occurs may be gathered from the fact that of 15,400 calves killed at the Berlin abattoir there were only four instances of tuberculosis. Cases of congenital tuberculosis in man have occasionally been described.

Baumgarten holds that in many cases the virus is transmitted, but the disease does not appear until some time after birth. He bases this opinion upon the following facts:

The great frequency of tuberculosis in sucklings. Thus, in 16,581 autopsies on sucklings, Frobelius found 416 with tuberculous lesions. In 219 cases of tuberculosis in children under two, from Parrot's clinic, there were 23 under three months, and a total of 111 under one year. It seems probable that in many of these cases the virus itself was transmitted.

The common occurrence of tuberculosis in the bones and in the joints of children, regions to which it seems unlikely that the bacilli would be conveyed in accidental infection. To make this objection valid we should require a series of cases of bone tuberculosis in children in which examination showed the lymph portals of the bronchi and the mesentery to be free from disease. He regards the late manifestation as analogous to the *syphilis hereditaria tarda*, and suggests that the growth of the germs is,

as a rule, restrained or held in check by the actively developing tissues of the child.

Tuberculosis unquestionably may be inherited, but in what way and how often are unsettled problems. Congenital disease is extremely rare, but there is no inherent improbability in a prolonged latency of the virus. That it may be present without the existence of actual tubercles is indicated by an experiment of Birch-Hirschfeld, who found that portions of the viscera of a fœtus born of a phthisical mother, though not itself tuberculous, were infective to guinea-pigs.

In any series of cases of pulmonary tuberculosis there is a suspicious number in which the ascendants have also been tuberculous. Thus, in 427 cases at the Johns Hopkins Hospital there were 53 in which the mother was affected, 52 in which the father had tuberculosis, and 105 in which brother or sister had had the disease. The estimates by various authors range from 10 per cent (Louis), 25 per cent (Walshe), to even 50 per cent. Fagge very justly remarks that it is impossible to draw a line between hereditary and accidental tuberculosis, and naturally the children of an affected parent are more liable to accidental contamination. Maternal is very much more common than paternal inheritance. A family tree, such as is here given, of six generations tells its own tale. It is interesting to note the almost constant transmission through the mother.

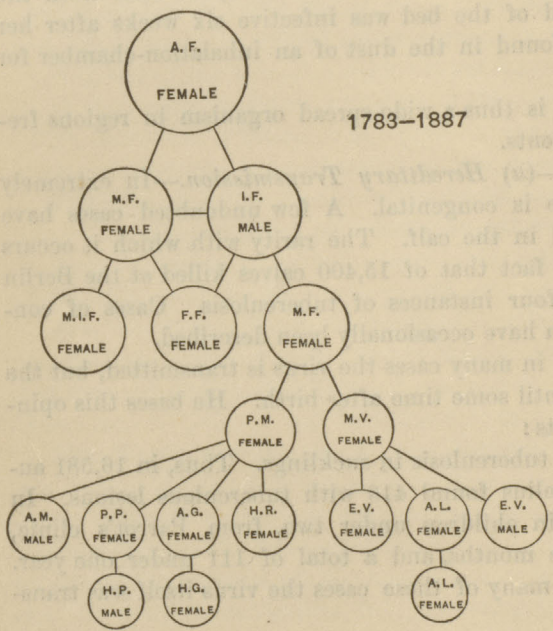


CHART XII.—Heredity in pulmonary tuberculosis.

(*b*) *Inoculation.*—The infective nature of tuberculosis was first demonstrated by Villemin, who showed conclusively in 1865 that it could be transmitted to animals by inoculation. The question was hotly contested, and Villemin's observations were confirmed by Simon, Andrew Clark, and others, but Burdon Sanderson, Wilson Fox, and others held that the disease could be transmitted by non-tuberculous materials. The beautiful experiments of Cohnheim and Salamonson, who produced tuberculosis in the eyes of guinea-pigs and rabbits by inoculating fresh tubercle into the ante-

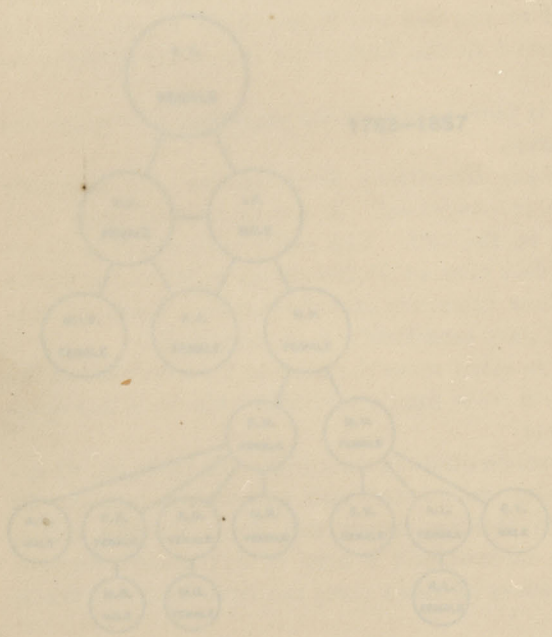


Chart XII.—Heredity in pulmonary tuberculosis.

rior chamber, confirmed and extended Villemin's original observations and paved the way for the reception of Koch's announcement. It is now universally conceded that *only* tuberculous matter can produce, when inoculated, tuberculosis. In man tuberculosis is not often transmitted by inoculation, and when it does occur the disease usually remains local. This mode of infection is seen in persons whose occupation brings them in contact with dead bodies or animal products. Demonstrators of morbid anatomy, butchers, and handlers of hides are subject to a local tubercle of the skin, which forms a reddened mass of granulation tissue, usually capping the dorsal surfaces of the hands or fingers. This is the so-called post-mortem wart, the *verruca necrogenica* of Wilks. The demonstration of its nature is shown by the presence of tubercle bacilli, and by inoculation experiments in animals.

The statement that Laennec contracted phthisis from this source is probably false, since he did not die until twenty years after the inoculation and in the interval presented no manifestations. The possibility, however, of general infection must be borne in mind. Gerber reports that after accidental inoculation of the hand from a case of phthisis he had for months a "Leichen-tubercle," which was excised. Shortly afterward the lymph-glands of the axilla became enlarged and painful, and when removed showed characteristic tuberculous changes, with bacilli.

In the performance of the rite of circumcision children have been accidentally inoculated. Infection in these cases is probably always associated with disease in the operator, and occurs in connection with the habit of cleansing the wound by suction.

Other means of inoculation have been described: as the wearing of ear-rings, washing the clothes of phthisical patients, the bite of a tuberculous subject, or inoculation from a cut by a broken spit-glass of a consumptive; and Czerny has reported two cases of infection by transplantation of skin.

It has been urged by the opponents of vaccination that tuberculosis, as well as syphilis, may be thus conveyed, but of this there is no evidence, and the lymph from the vesicles of revaccinated consumptives has been shown by many observers to be non-infective. It may be said, on the whole, that inoculation in man plays a trifling *rôle* in the transmission of tuberculosis.

(*c*) *Infection through the Air.*—It has been fully proved that the expired air of tuberculous patients is not infective. On the other hand, the virus is contained in enormous amounts in the sputum, which, when dried, is soon widely disseminated in the form of dust, and unless carefully sterilized constitutes a great medium of transmission. A belief in the contagiousness of pulmonary tuberculosis has existed from the days of the early Greek physicians, and has persisted among the Latin races.

The investigations of Cornet afford conclusive proof that the dust of a

room or other locality frequented by patients with pulmonary tuberculosis is infective. The bacilli are attached to fine particles of dust and in this way gain entrance to the system through the lungs. The following are some of the facts in favor of this view:

(1) Primary tuberculous lesions are in a majority of all cases connected with the respiratory system. The frequency with which foci are met with in the lungs and in the bronchial glands is extraordinary, and the statistics of the Paris morgue show that a considerable proportion of all persons dying of accident or by suicide present evidences of the disease in these parts. The post-mortem statistics of hospitals show the same wide-spread prevalence of infection through the air-passages. Biggs reports that more than 60 per cent of his post-mortems showed lesions of pulmonary tuberculosis. In one hundred and twenty-five post-mortems at the Foundling Hospital, New York, the bronchial glands were tuberculous in every case. In adults the bronchial glands may be infected while the individual is in good health. H. P. Loomis found in eight of thirty cases in which there were no signs of old or recent tuberculous lesions that the bronchial glands were infective to rabbits.

(2) The greater prevalence of tuberculosis in institutions in which the residents are confined and restricted in the matter of fresh air and a free open life—conditions which would favor, on the one hand, the presence of the bacilli in the atmosphere, and, on the other, lower the vital resistance of the individual. The investigations of Cornet upon the death-rate from consumption among certain religious orders devoted to nursing give some striking facts in illustration of this. In a review of thirty-eight cloisters, embracing the average number of 4,028 residents, among 2,099 deaths in the course of twenty-five years, 1,320 (62·88 per cent) were from tuberculosis. In some cloisters more than three fourths of the deaths are from this disease, and the mortality in all the residents, up to the fortieth year, is greatly above the average, the increase being due entirely to the prevalence of tuberculosis. It has been stated that nurses are not more prone to the disease than other individuals, but Cornet says that of a hundred nurses deceased, sixty-three died of tuberculosis. The more perfect the prophylaxis and hygienic arrangements of an asylum or institution, the lower the mortality from tuberculosis. The mortality in prisons has been shown by Baer to be four times as great as outside. The death-rate from phthisis is estimated at 15 per cent of the total mortality, while in prisons it constitutes from 40 to 50 per cent, and in some countries, as Austria, over 60 per cent. Flick has studied the distribution of the deaths from tuberculosis in a single city ward in Philadelphia for twenty-five years. His researches go far to show that it is a house disease. About 33 per cent of infected houses have had more than one case. Less than one third of the houses of the ward became infected with tuberculosis during the twenty-five years prior to 1888. Yet more than one half of the deaths from this disease during the year 1888 occurred in those in-

Butter made from the milk of tuberculous cows has also proved infective (Bang and Roth).

fected houses. There are, however, opposing facts. The statistics of the Brompton Consumption Hospital show that doctors, nurses, and attendants are rarely attacked. Dettweiler claims that no case of tuberculosis has been contracted among his nurses or attendants at Falkenstein. The whole question has recently been thoroughly reviewed by Heron,* in whose work will also be found a list of cases of infection (prepared by Koch) reported between 1867 and 1889.

(3) Special danger exists when the contact is very intimate, such, for instance, as between man and wife. On this point much difference of opinion exists, but the figures seem to indicate that under these circumstances the husband or wife is much more liable subsequently to die of consumption. Of 427 cases of pulmonary tuberculosis at the Johns Hopkins Hospital, in 25 either husband or wife had been affected with it or had died of tuberculosis. In response to a question as to contagion, asked by the Collective Investigation Committee of the British Medical Association, there were 261 replies in the affirmative, among which were 158 cases of supposed contagion through marriage. Weber's cases are of special interest. One of his patients lost four wives in succession, one lost three, and four lost two each.

(*d*) *Infection by Milk.*—The milk of an animal suffering from tuberculosis may contain the virus, and is capable of communicating the disease, as shown by Gerlach, Bang, Bollinger, and others. Striking illustrations of this are sometimes afforded in the lower animals. The pigs, for instance, of a tuberculous sow have been shown to present intestinal tuberculosis of the most exquisite form. Of late years the experimental proof has been entirely conclusive. It was formerly thought that the cow must present tuberculous disease of the udder, but Ernst has shown that the bacilli may be present and the milk be infective in a large proportion of cases in which there is no tuberculous mammitis; an observation made also by Hirschberger and others. This author states the interesting fact that an owner of a herd known to be tuberculous withdrew the milk from market and used it without boiling to fatten his pigs, which, almost without exception, became tuberculous, so that the whole stock had to be slaughtered. There is no reason to believe that young children or even adults are less susceptible to the virus than calves or pigs, so that the danger of the disease from this source is real and serious. The great frequency of intestinal and mesenteric tuberculosis in children no doubt finds here its explanation. As noted in Woodhead's analysis of one hundred and twenty-seven cases of fatal tuberculosis in children, the mesenteric glands were involved in one hundred.

(*e*) *Infection by Meat.*—The meat of tuberculous animals is not necessarily infective. The results of experiments with the flesh of cows are not in accord. This mode of infection probably plays a minor *rôle* in the

* Evidences of the Communicability of Consumption, London, 1890.

etiology of human tuberculosis, as usually the flesh is thoroughly cooked before eating. The possibility, however, must be borne in mind, and it would certainly be safer in the interests of a community to confiscate the carcasses of all tuberculous animals. Experiments in Bollinger's laboratory show that the flesh of tuberculous subjects is very infective to guinea-pigs.

6. **Conditions influencing Infection.**—(*a*) *Constitutional Peculiarities.*—It was formerly thought that individuals of a certain habit of body, and of a certain physiognomy, the *habitus phthisicus*, were specially prone to tuberculous disease; but few now regard the so-called tuberculous or scrofulous diathesis as more than an indication of a certain type of conformation, in which the tissues are more vulnerable and less capable of resisting infection. In many instances Cohnheim is unquestionably correct in stating that the so-called phthisical *habit* is not an indication of a tendency to, but actually of the existence of, tuberculosis. The belief in a special phthisical frame has existed in the profession from the days of Hippocrates, who says, "The form of body peculiar to subjects of phthisical complaints was the smooth, the whitish, that resembling the lentil; the reddish, the blue-eyed, the leuco-phlegmatic, and that with the scapulæ having the appearance of wings." Galen also wrote upon this type of chest as specially characteristic of the disease. Certainly the long, narrow, flat chest with depressed sternum is most commonly seen in tuberculous persons, but how common it is also to meet with patients who have well-formed, well-built chests, with wide costal angle and good pulmonary expansion! The investigations of Beneke with reference to the formation of the viscera in the subjects of phthisis are very interesting. His measurements indicate that the heart is relatively small, the arteries are proportionately narrow, and the pulmonary artery is relatively wider than the aorta. This point, he suggests, would lead to increase in the blood-pressure in the lungs and favor catarrh. The lung volume he found to be relatively greater in those affected with phthisis.

Galton and Mahomed made observations upon the composite portraiture of phthisis. In 442 patients they separated two types of face; one ovoid and narrow, the other broad and coarse featured. This corresponds in an interesting way to the diathetic states formerly recognized—namely, the tuberculous, with thin skin, bright eyes, oval face, and long, thin bones; and the scrofulous, with thick lips and nose, opaque skin, large thick bones, and heavy figure. These conditions, on which so much stress was formerly laid, indicate, as Fagge states, nothing more than delicacy of constitution, incomplete growth, and imperfect development.

(*b*) *Influence of Age.*—Tuberculosis occurs at all periods of life, in the suckling as well as in the octogenarian. The distribution of the lesions varies greatly at different ages. In the first decade the lymphatic glands, bones, and meninges are much more frequently affected than at subsequent periods. Meningeal tuberculosis is most common between the third and eighth years.

The mesenteric glands are specially prone to be involved in young children, as before mentioned. Of 127 cases of tuberculosis in children, Woodhead found these bodies affected in 100 instances, in 14 of which there were no tubercles in other parts of the body. The majority of these cases occur between the first and fifth years. The bronchial glands are still more frequently involved, and of 125 cases at the New York Foundling Hospital in every one were these structures the seat of more or less extensive tuberculosis.

In adults the lungs usually contain tubercle when it is present in the body (Louis' law).

(*c*) *Soil and locality* are held by many to have an important influence in tuberculosis. The observations of H. I. Bowditch in this country, and of Buchanan in England, show that pulmonary tuberculosis is more prevalent in damp, ill-drained districts; but this increased incidence is most probably associated with a heightened vulnerability due to an increased liability to catarrhal affections of all kinds.

(*d*) *Local Conditions influencing Infection.*—These are doubtless of the highest importance, and second only to the constitutional vulnerability. Among the more important may be mentioned:

Catarrhal Inflammation.—This probably acts by lowering the resistance, or, in modern parlance, reducing the activity of the phagocytes and allowing the bacilli to pass the portals. The liability of infection in the cervical and bronchial glands in children is probably associated with the common occurrence of catarrhal processes in the throat and bronchi.

The influence of bronchial catarrh in pulmonary tuberculosis is all-important. How often is it said that the disease has started in a neglected cold, which means, in other words, that the bronchial catarrh has enfeebled the power of tissue resistance, or produced conditions favorable to the growth and development of the bacilli!

An important part in the etiology of tuberculous processes is played by *trauma.* Surgeons have for years laid great stress upon this association, but the relation, though universally recognized, is by no means easy of explanation. Bacteriological experiments, however, indicate that in tissues which have been injured organisms, which would in health have been readily and rapidly destroyed by the action of the normal juices or cells, under these altered circumstances grow rapidly and develop. Probably in the case of tuberculosis following trauma the injured part is for a time a *locus minoris resistentiæ*, and if bacilli are present they may by it receive a stimulus to growth, or under the altered conditions be capable of multiplying. Not only in arthritis but in pulmonary tuberculosis traumatism may play a part. The question has been thoroughly studied by Mendelsohn,* who reports nine cases in which, without fracture of the

* Zeitschrift f. klin. Medicin, Bd. 10.

rib or laceration of the lung, tuberculosis developed shortly after contusion of the chest.

The production of general tuberculosis is sometimes favored by *operation* upon tuberculous lesions. Surgeons have long known that resection of a strumous joint is occasionally followed by acute tuberculosis. The question has been carefully studied by Wartmann,* who gives statistics of 837 resections. Of these, 225 ended fatally, 26 with acute tuberculosis, the outbreak of which was directly associated with operation.

The acute miliary tuberculosis which, as Litten has shown, occasionally follows the aspiration of the effusion in tuberculous pleurisy, may come under this division.

The constant inhalation of *impure air* in occupations associated with a very dusty atmosphere renders the lungs less capable of resisting infection. The pulmonary affection of stone-cutters and coal-miners, though non-tuberculous at the outset and often a simple chronic interstitial pneumonia, is ultimately in a large proportion of the cases tuberculous. In manufactories metallic seems more hurtful than mineral dust. Peterson† quotes the incidence of pulmonary tuberculosis among the trades as follows: Glass-workers, 80 per cent; needle-sharpeners, 70; file-cutters, 62; and stone-cutters, 60. And, lastly, circumstances which temporarily lower the nutrition, as the *specific fevers* render the tissues more susceptible. In this way alone can we explain the frequent onset of tuberculosis after an exhausting illness. Fevers, such as measles and whooping-cough, which are associated with bronchial catarrh, are more prone than others to be followed by tuberculosis. This is often only the blazing of a smouldering fire.

General Morbid Anatomy and Histology of Tuberculous Lesions.

(1) **Distribution of the Tubercles in the Body.**—The organs of the body are variously affected by tuberculosis. In adults, the lungs may be regarded as the seat of election; in children, the lymph-glands, bones, and joints. In 1,000 autopsies there were 275 cases with tuberculous lesions. With but two or three exceptions the lungs were affected. The distribution in the other organs was as follows: Pericardium, 7; peritonæum, 36; brain, 31; spleen, 23; liver, 12; kidneys, 32; intestines, 65; heart, 4; and generative organs, 8.

The tuberculosis which comes under the care of the surgeon has a different distribution, as shown by the following figures from the Wurzburg clinic: Among 8,873 patients there were 1,287 tuberculous, with the following distribution of lesions: Bones and joints, 1,037; lymph-glands, 196; skin and connective tissues, 77; mucous membranes, 10; genito-urinary organs, 20.

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* Deutsche Zeitschrift f. Chirurgie, Bd. 24.

† Medical News, 1885.

(2) The Changes produced by the Tubercle Bacilli.

(*a*) *The Nodular Tubercle.*—The body which we term a "tubercle" *presents in its early formation nothing distinctive or peculiar, either in its components or in their arrangement.* Identical structures are produced by other parasites, such as the actinomyces, and by the strongylus in the lungs of sheep.

The researches of Baumgarten have enabled us to follow in detail all the steps in the development of a tubercle.

These are: (α) The multiplication of the fixed cells, especially those of connective tissue and the endothelium of the capillaries, and the gradual production from them of rounded, cuboidal, or polygonal bodies with vesicular nuclei—the *epithelioid cells*—inside some of which the bacilli are soon seen.

(β) From the vessels of the infected focus, leucocytes migrate in numbers and form the lymphoid cells which were thought to be so characteristic of tubercle. They do not, however, undergo division.

(γ) A reticulum of fibres is formed by the fibrillation and rarefaction of the connective-tissue matrix. This is most apparent, as a rule, at the margins of the growth.

(δ) In some, but not all, tubercles *giant cells* are formed by an increase in the protoplasm and in the nuclei of an individual cell, or possibly by the fusion of several cells. The giant cells seem to be in inverse ratio to the number and virulence of the bacilli. In lupus, joint tuberculosis, and scrofulous glands, in which the bacilli are scanty, the giant cells are numerous; while in miliary tubercles and all lesions in which the bacilli are abundant the giant cells are few in number.

The bacilli then cause, in the first place, a proliferation of the fixed elements, with the production of epithelioid and giant cells; and, secondly, an inflammatory reaction, associated with exudation of leucocytes. How far the leucocytes attack and destroy the bacilli has not been definitely settled—Metschnikoff claiming, Baumgarten denying, an active phagocytosis.

Once formed, a tubercle undergoes caseation and sclerosis.

Caseation.—At the central part of the growth, owing to the direct action of the bacilli, a process of coagulation necrosis goes on in the cells, which lose their outline, become irregular, no longer take stains, and are finally converted into a homogeneous, structureless substance. Proceeding from the centre outward, the tubercle may be gradually converted into a yellowish-gray body, in which, however, the bacilli are still abundant. No blood-vessels are found in them. Aggregated together these form the cheesy masses so common in tuberculosis, which may undergo (*a*) softening; (*b*) fibroid limitation (encapsulation); (*c*) calcification.

Sclerosis.—With the necrosis of the cell elements at the centre of the tubercle, hyaline transformation proceeds, together with great increase in the fibroid elements; so that the tubercle is converted into a firm, hard

structure. Often the change is rather of a fibro-caseous nature; but the sclerosis predominates. In some situations, as the peritonæum, this seems to be the natural transformation of tubercle, and it is by no means rare in the lungs.

In all tubercles two processes go on: the one—caseation—destructive and dangerous; and the other—sclerosis—conservative and healing. The ultimate result in a given case depends upon the capabilities of the body to restrict and limit the growth of the bacilli. There are tissue-soils in which the bacilli are, in all probability, killed at once—*the seed has fallen by the wayside.* There are others in which a lodgment is gained and more or less damage done, but finally the day is with the conservative, protecting forces—*the seed has fallen upon stony ground.* Thirdly, there are tissue-soils in which the bacilli grow luxuriantly, caseation and softening, not limitation and sclerosis, prevail, and the day is with the invaders—*the seed has fallen upon good ground.*

The action of the bacilli injected directly into the blood-vessels illustrates many points in the histology and pathology of tuberculosis. If into the vein of a rabbit a pure culture of the bacilli is injected, the microbes accumulate chiefly in the liver and spleen. The animal dies usually within two weeks, and the organs apparently show no trace of tubercles. Microscopically, in both spleen and liver the young tubercles in process of formation are very numerous, and the process of karyokinesis is seen in the liver-cells. After an injection of a more dilute culture, or one whose virulence has been mitigated by age, instead of dying within a fortnight the animal survives for five or six weeks, by which time the tubercles are apparent in the spleen and liver, and often in the other organs.

(*b*) *The Diffuse Infiltrated Tubercle.*—This is most frequently seen in the lungs. Only a great master like Virchow could have won the profession from a belief in the *unity of phthisis*, which the genius of Laennec had, on anatomical ground, announced. Here and there a teacher, as Wilson Fox, protested, but the heresy prevailed, and we repeated the striking aphorism of Niemeyer, "The greatest evil which can happen to a consumptive is that he should become tuberculous." It was thought that the products of any simple inflammation might become caseous and that ordinary catarrhal pneumonia terminated in phthisis. It was peculiarly fitting that from Germany, in which the dualistic heresy arose, the truth of Laennec's views should receive incontestable proof, in the demonstration by Koch of the etiological unity of all the various processes known as tuberculous and scrofulous.

Infiltrated tubercle results from the fusion of many small foci of infection—so small indeed that they may not be visible to the naked eye, but which histologically are seen to be composed of scattered centres, surrounded by areas in which the air-cells are filled with the products of exudation and of the proliferation of the alveolar epithelium. Under the influence of the bacilli, caseation takes place, usually in small groups of

lobules, occasionally in an entire lobe, or even the greater part of a lung. In the early stage of the process, the tissue has a gray gelatinous appearance, the *gray infiltration* of Laennec. The alveoli contain a sero-fibrinous fluid with cells, and the septa are also infiltrated. These cells accumulate and undergo coagulation necrosis, forming areas of caseation, the *infiltration tuberculeuse jaune* of Laennec, the scrofulous or cheesy pneumonia of later writers. There may also be a diffuse infiltration and caseation without any special foci, a wide-spread tuberculous pneumonia induced by the bacilli.

After all, the two processes are identical. As Baumgarten states: "there is no well-marked difference between miliary tubercle and chronic caseous pneumonia. Speaking histologically, miliary tuberculosis is nothing else than a chronic caseous miliary pneumonia, and chronic caseous pneumonia is nothing but a tuberculosis of the lungs."

(*f*) *Secondary Inflammatory Processes.*—(1) The irritation of the bacilli invariably produces an inflammation which may, as has been described, be limited to exudation of leucocytes and serum, but may also be much more extensive, and varies with varying conditions. We find, for example, about the smaller tubercles in the lungs, pneumonia—either catarrhal or fibrinous, proliferation of the connective-tissue elements in the septa (which also become infiltrated with round cells), and changes in the blood and lymph vessels.

(2) In processes of minor intensity the inflammation is of the slow reactive nature, which results in the production of a cicatricial connective tissue which limits and restricts the development of the tubercles and is the essential conservative element in the disease. It is to be remembered that in chronic pulmonary tuberculosis much of the fibroid tissue which is present is not in any way associated with the action of the bacilli.

(3) Suppuration. Do the bacilli themselves induce suppuration? In so-called cold tuberculous abscess the material is not histologically pus, but a *débris* consisting of broken-down cells and cheesy material. It is moreover sterile—that is, does not contain the usual pus organisms. The products of the tubercle bacilli are probably able to induce suppuration, as in joint and bone tuberculosis pus is frequently produced, although this may be due to a mixed infection. Koch, it will be remembered, states that the "tuberculin" is one of the best agents for the production of experimental suppuration. In tuberculosis of the lungs the suppuration is largely the result of an infection with pus organisms.

II. Acute Tuberculosis.

The truly infective nature of tubercle is best shown in this affection, which is characterized by an eruption of miliary tubercles in various parts of the body. The clinical picture varies with the general or localized distribution of the growths. The tubercles are found upon the pleura and

peritonæum; in the lungs, liver, kidneys, lymph-glands, and spleen; upon the membranes of the brain, occasionally in the choroid coat of the eye, and in the bone-marrow. They may be abundant in some organs and scanty in others. Thus, in the meninges of the brain they may be thickly set, while there are few or none in the abdominal viscera or in the lungs. On the other hand, the lungs may be stuffed with granulations while the meninges of the brain are free. In other cases, again, the distribution is uniform in all the viscera.

The *etiology* has been in part considered, and the only additional statement necessary is that in a great majority of all cases it is an *auto-infection*, arising from a pre-existing tuberculous focus, which may be latent and unsuspected. The following are the most common sources of general infection: Local disease of the lungs, which may be quite limited and unproductive of symptoms; tuberculous affection of the lymph-glands, particularly in children; and tuberculosis of the bones and of the kidneys. Of these sources perhaps the most common are the tracheal and bronchial lymph-glands, which are so often the seat of local tuberculosis. Weigert has shown that in many cases the infection results from the rupture of a caseous pulmonary nodule into a vein, or of a caseous bronchial gland into one of the pulmonary veins. A general infection may, as shown by Ponfick, result from invasion of the thoracic duct by tubercles. With special care the source of infection can usually be discovered at post-mortem examination. The connection between tuberculous lymph-glands and veins has often been demonstrated. In many instances it is impossible to say what determines the sudden and violent onset of the disease. It would seem sometimes as if general rather than local conditions influenced the outbreak. After certain fevers, particularly measles and whooping-cough in children—affections, it is true, which are associated with long-continued bronchitis—miliary tuberculosis is not uncommon. The prostration and constitutional weakness which follow protracted fevers frequently seem in the adult a predisposing cause.

Clinical Forms.—For practical purposes the cases may be divided into those with the symptoms of *acute general infection* without special localization; cases with marked *pulmonary* symptoms; and cases with *cerebral* or *cerebro-spinal* symptoms.

Other forms have been recognized, but this division covers a large majority of the cases.

Taking any series of cases it will be found that the meningeal form of acute tuberculosis exceeds in numbers the cases with general or marked pulmonary symptoms.

1. **General or Typhoid Form.**—*Symptoms.*—The patient here presents the symptoms of an infectious disease with few if any local symptoms. The cases simulate and are frequently mistaken for typhoid fever. After a period of failing health, with loss of appetite, the patient becomes feverish and weak. Occasionally the disease sets in more abruptly, but in

peritonæum; in the lungs, liver, kidneys, lymph-glands, and spleen; upon the membranes of the brain, occasionally in the choroid coat of the eye, and in the bone-marrow. They may be abundant in some organs and scanty in others. Thus, in the meninges of the brain they may be thickly set, while there are few or none in the abdominal viscera or in the lungs. On the other hand, the lungs may be stuffed with granulations while the meninges of the brain are free. In other cases, again, the distribution is uniform in all the viscera.

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many instances the anamnesis closely resembles that of typhoid fever. Nose-bleeding, however, is rare. The temperature increases, the pulse becomes rapid and feeble, the tongue dry; delirium becomes marked and the cheeks are flushed. The pulmonary symptoms may be very slight; usually bronchitis exists, but not more severe than is common with typhoid fever. The pulse is seldom dicrotic, but is rapid in proportion to the pyrexia. Perhaps the most striking feature of the temperature is the irregularity; and if seen from the outset there is not the steady ascent noted in typhoid fever. There is usually an evening rise to 103°, sometimes 104°, and a morning remission of from two to three degrees. Sometimes the pyrexia is intermittent, and the thermometer may register below normal during the early morning hours. The inverse type of temperature, in which the rise takes place in the morning, is held by some writers to be more frequent in general tuberculosis than in other diseases. In rare instances there may be little or no fever. On two occasions I have had a patient admitted to my wards in a condition of profound debility, with a history of illness of from three to four weeks' duration, with rapid pulse, flushed cheeks, dry tongue, and very slight elevation in temperature, in whom (post mortem) the condition proved to be general tuberculosis. In one instance there was tolerably extensive disease at the right apex. Reinhold, from Bäumler's clinic, has recently called attention to these afebrile forms of acute tuberculosis. In nine of fifty-two cases there was no fever, or only a transient rise.

In a considerable number of these cases the respirations are increased in frequency, particularly in the early stage, and there may be signs of diffuse bronchitis and slight cyanosis. Cheyne-Stokes breathing develops toward the close.

Active delirium is rare. More commonly there are torpor and dullness, gradually deepening into coma, in which the patient dies. In some cases the pulmonary symptoms become more marked; in others, meningeal or cerebral features develop.

Diagnosis.—The differential diagnosis between general miliary tuberculosis without local manifestations and typhoid fever is extremely difficult. A point of importance, to which reference has already been made, is the irregularity of the temperature curve. The greater frequency of the respirations and the tendency to slight cyanosis is much more common in tuberculosis. There are cases, however, of typhoid fever in which the initial bronchitis is severe and may lead to dyspnœa and disturbed oxygenation. The cough may be slight or absent. Diarrhœa is rare in tuberculosis; the bowels are usually constipated; but diarrhœa may occur and persist for days. In certain cases the diagnosis has been complicated still further by the occurrence of blood in the stools. Enlargement of the spleen occurs in general tuberculosis, but is neither so early nor so marked as in typhoid fever. In children, however, the enlargement may be considerable. The urine may show traces of albumen, and unfortu-

nately Ehrlich's diazo-reaction, which is so constant in typhoid fever, is also met with in general tuberculosis. The absence of the characteristic roseola is an important feature. Occasionally in acute tuberculosis reddish spots may develop and for a time cause difficulty, but they do not come out in crops, and rarely have the characters of the true typhoid eruption. Herpes is perhaps more common in tuberculosis. Toward the close, petechiæ may appear on the skin, particularly about the wrists. A rare event is jaundice, due possibly to the eruption of tubercles in the liver.

In a few instances the presence of tubercle bacilli has been demonstrated in the blood, which in doubtful cases should therefore be examined. The spleen has been punctured and cultivations made to determine the presence or absence of the typhoid bacilli. The eye-grounds should be carefully examined for choroidal tubercles. Leucocytosis occurs in acute tuberculosis, but not in typhoid fever.

2. **Pulmonary Form.**—*Symptoms.*—From the outset the pulmonary symptoms are marked. The patient may have had a cough for months or for years without much impairment of health, or he may be known to be the subject of chronic pulmonary tuberculosis. In other instances, particularly in children, the disease follows measles and whooping-cough, and is of a distinctly broncho-pneumonic type. The disease begins with the symptoms of diffuse bronchitis. The cough is marked, the expectoration muco-purulent, occasionally rusty. Hæmoptysis has been noted in a few instances. From the outset dyspnœa is a striking feature and may be out of proportion to the intensity of the physical signs. In adults, the respirations may be as hurried as in acute pneumonia, reaching from fifty to sixty; in children, as high as eighty or more. There is more or less cyanosis of the lips and finger-tips, and the cheeks are suffused. Apart from emphysema and the later stages of severe pneumonia I know of no other pulmonary condition in which the cyanosis is so marked. The physical signs are those of bronchitis. There is rarely much alteration in the percussion note. In children there may be defective resonance at the bases, from scattered areas of broncho-pneumonia; or, what is equally suggestive, areas of hyper-resonance. Indeed, the percussion note, particularly in the front of the chest, in some cases of miliary tuberculosis, is full and clear, and it will be noted (post mortem) that the lungs are unusually voluminous. This is probably the result of more or less wide-spread acute emphysema. On auscultation, the râles are either sibilant and sonorous or small, fine, and crepitant. There may be fine crepitation from the occurrence of tubercles on the pleura (Jürgensen). In children there may be high-pitched tubular breathing at the bases or toward the root of the lung. Toward the close the râles may be larger and more mucous. The temperature rises to 102° or 103°, and may present the inverse type. The pulse is rapid and feeble. In the very acute cases the spleen is always enlarged. The disease may prove fatal in ten or twelve days, or may be protracted for weeks or even months.

Diagnosis.—The diagnosis of this form offers less difficulty and is more frequently made. There is often a history of previous cough, or the patient is known to be the subject of local disease of the lung, or of the bronchial glands, or of the bones. In children these symptoms following measles or whooping-cough indicate in the majority of cases acute miliary tuberculosis, with or without broncho-pneumonia. Occasionally the sputum contains tubercle bacilli.

It is to be remembered that acute lesions of tuberculosis & typhoid fever have been demonstrated in the same body (Kitasato & Willard Soc. de Biol. 1893

but this is a dangerous procedure

Look up Lemoyne's case Tub.

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The choroidal tubercle occurs in a limited number of cases and may help the diagnosis. More important in an adult is the combination of dyspnœa with cyanosis and the signs of a diffuse bronchitis. In some instances the occurrence of cerebral symptoms at once give a clew to the nature of the trouble.

3 **Meningeal Form** (*Tuberculous Meningitis*).—This affection, which is also known as acute hydrocephalus or "water on the brain," is essentially an acute tuberculosis in which the membranes of the brain, sometimes of the cord, bear the brunt of the attack.

There are several special *etiological* factors in connection with this form. It is much more common in children than in adults. It is rare during the first year of life, more frequent between the second and the fifth years. In a majority of the cases a focus of old tuberculous disease will be found, commonly in the bronchial or mesenteric glands. In a few instances the affection seems to be primary in the meninges. It is very difficult, however, in an ordinary post-mortem to make an exhaustive search, and the lesion may be in the bones, sometimes in the middle ear, or in the genito-urinary organs. In those instances in which no primary focus has been discovered it has been suggested that the bacilli reach the meninges through the cribriform plate of the ethmoid from the upper part of the nostrils, but this is not probable.

Morbid Anatomy.—Tuberculous meningitis presents a very characteristic picture. The meninges at the base are most involved, hence the term basilar meningitis. The parts about the optic chiasm, the Sylvian fissures, and the interpeduncular space are affected. There may be only slight turbidity and matting of the membranes, and a certain stickiness with serous infiltration; but more commonly there is a turbid exudate, fibrino-purulent in character, which covers the structures at the base, surrounds the nerves, extends out in the Sylvian fissures, and appears on the lateral, rarely on the upper, surfaces of the hemispheres. The tubercles may be very apparent, particularly in the Sylvian fissures, appearing as small, whitish nodules on the membranes. They vary much in number and size, and may be difficult to find. The amount of exudate bears no definite relation to the abundance of tubercles. The arteries of the anterior and posterior perforated spaces should be carefully withdrawn and searched, as upon them nodular tubercles may be found when not present elsewhere. In doubtful cases the middle cerebral arteries should be very carefully removed, spread on a glass plate with a black background, and examined

with a low objective. The tubercles are then seen as nodular enlargements on the smaller arteries. The lateral ventricles are dilated (acute hydrocephalus) and contain a turbid fluid; the ependyma may be softened, and the septum lucidum and fornix are usually broken down. The convolutions are often flattened and the sulci obliterated owing to the increased intra-ventricular pressure. Histologically the tubercles are seen to develop in the perivascular sheaths, producing circumscribed aggregations of lymphoid and epithelioid cells. The lumen of the vessel is narrowed and thrombosis may result. The meninges are not alone involved, but the contiguous cerebral substance is more or less œdematous and infiltrated with leucocytes, so that anatomically the condition is in reality a *meningo-encephalitis*.

There are instances in which the acute process is associated with chronic meningeal tuberculosis; cases which may for months present the clinical picture of brain tumor.

Although in a majority of instances the process is cerebral, the spinal meninges may also be involved, particularly those of the cervical cord. There are cases indeed in which the symptoms are chiefly spinal. A sailor, who had fallen on the deck three weeks before his death, was admitted to the Montreal General Hospital. He presented signs of meningitis, chiefly spinal, which were naturally attributed to traumatism. The post-mortem showed absence of tubercles and lymph at the base of the brain, and an extensive eruption of miliary tubercles with much turbid lymph over the entire spinal meninges. There were small cheesy masses at the apices of the lungs.

Symptoms.—Tuberculous meningitis presents an extremely complex clinical picture. It will be best to describe the form found in children.

Prodromal symptoms are common. The child may have been in failing health for some weeks, or may be convalescent from measles or whooping-cough. In many instances there is a history of a fall. The child gets thin, is restless, peevish, irritable, loses its appetite, and the disposition may completely change. Symptoms pointing to the disease may then set in, either quite suddenly with a convulsion, or more commonly with headache, vomiting, and fever, three essential symptoms of the onset which are rarely absent. The pain may be intense and agonizing. The child puts its hand to its head and occasionally, when the pain becomes worse, gives a short, sudden cry, the so-called hydrocephalic cry. Sometimes the child screams continuously until utterly exhausted. I saw in West Philadelphia a case of basilar meningitis in a girl of thirteen, who for three days, when not under the influence of a powerful sedative or of chloroform, screamed at the top of her voice so as to be heard a square or more away. The vomiting is without apparent cause, and is independent of taking of food. Constipation is usually present. The fever is slight, but gradually rises to 102° or 103°. The pulse is at first rapid, subsequently irregular and slow. The respirations are rarely altered. During

sleep the child is restless and disturbed. There may be twitchings of the muscles, or sudden startings; or the child may wake up from sleep in great terror. In this early stage the pupils are usually contracted. These are the chief symptoms of the initial stage, or, as it is termed, the *stage of irritation.*

In the second period of the disease these irritative symptoms subside; vomiting is no longer marked, the abdomen becomes retracted, boat-shaped or *carinated.* The bowels are obstinately constipated, the child no longer complains of headache, but is dull and apathetic, and when roused is more or less delirious. The head is often retracted and the child utters an occasional cry. The pupils are dilated or irregular, and a squint may develop. Sighing respiration is common. Convulsions may occur, or rigidity of the muscles of one side or of one limb. The temperature is variable, ranging from 100° to 102·5°. A blotchy erythema is not uncommon on the skin. If the finger-nail is drawn across the skin of any region a red line comes out quickly, the so-called *tâche cérébrale,* which, however, has no diagnostic significance.

In the final period, or stage of *paralysis,* the coma increases and the child cannot be roused. Convulsions are not infrequent, and there are spasmodic contractions of the muscles of the back and neck. Spasms may occur in the limbs of one side. Optic neuritis and paralysis of the ocular muscles may be present. The pupils become dilated, the eyelids are only partially closed, and the eyeballs are rolled up so that the corneæ are only covered in part by the upper eyelid. Diarrhœa may develop, the pulse becomes rapid, and the child may sink into a typhoid state with dry tongue, low delirium, and involuntary passages of urine and fæces. The temperature often becomes subnormal, sinking in rare instances to 93° or 94°. In some cases there is ante-mortem elevation of temperature, the fever rising to 106°. The entire duration of the disease is from a fortnight to three or four weeks.

There are cases of tuberculous meningitis which pursue a more rapid course. They set in with great violence, often in persons apparently in good health, and may prove fatal within a few days. In these instances, more commonly seen in adults, the convex surface of the brain is usually involved. There are again instances which are essentially chronic and display symptoms of a limited meningitis; sometimes with pronounced psychical symptoms, and sometimes with those of cerebral tumor.

There are certain features which call for special comment.

The irregularity and slowness of the pulse in the early and middle stages of the disease are points upon which all authors agree. Toward the close, as the heart's action becomes weaker, the pulsations are more frequent. The temperature is usually elevated, but there are instances in which it does not rise in the whole course of the disease much above 100°. It may be extremely irregular, and the oscillations are often as much as three or four degrees in the day. Toward the close the temperature may

sink to 95°, occasionally to 94°, or there may be hyperpyrexia. In a case of Bäumler's the temperature rose before death to 43·7° C. (110·7° F.).

The ocular symptoms of the disease are of special importance. In the early stages narrowing of the pupils is the rule. Toward the close, with increase in the intra-cranial pressure, the pupils dilate and are irregular. There may be conjugate deviation of the eyes. Of ocular palsies the third nerve is most frequently involved. The changes in the eye-grounds are very important. Neuritis is the most common. According to Gowers, the disk at first becomes full colored and has hazy outlines, and the veins are dilated. Swelling and striation become pronounced, but the neuritis is rarely intense. Of twenty-six cases studied by Garlick, in six the condition was of diagnostic value. The tubercles in the choroid are rare and much less frequently seen during life than post-mortem figures would indicate. Thus Litten found them (post mortem) in thirty-nine out of fifty-two cases. They were present in only one of the twenty-six cases of tuberculous meningitis examined by Garlick. I have never met them clinically, and have only found two instances post mortem. Heinzel examined with negative results forty-one cases.

Among the motor symptoms convulsions are most common, but there are other changes which deserve special mention. A tetanic contraction of one limb may persist for several days, or a cataleptic condition. Tremor and athetoid movements are sometimes seen. The paralyses are either hemiplegias or monoplegias. Hemiplegia may result from disturbance in the cortical branches of the middle cerebral artery, occasionally from softening in the internal capsule, due to involvement of the central branches. Of monoplegias, that of the face is perhaps most common, and if on the right side it may occur with aphasia. In two of my cases in adults aphasia developed. Brachial monoplegia may be associated with it. In the more chronic cases the symptoms persist for months, and there may be a characteristic Jacksonian epilepsy when the tubercles involve the meninges of the motor cortex.

The *prognosis* in this form of meningitis is always most serious. I have neither seen a case which I regarded as tuberculous recover, nor have I seen post-mortem evidence of past disease of this nature. Cases of recovery have been reported by reliable authorities, but they are extremely rare, and there is always a reasonable doubt as to the correctness of the diagnosis. The differential features will be considered in connection with acute meningitis.

III. Tuberculosis of the Lymph-glands (*Scrofula*).

Scrofula is tubercle, as it has been shown that the bacillus of Koch is the essential element. It is not yet definitely settled whether the virus which produces the chronic adenitis or scrofula differs from that which produces tuberculosis in other parts, or whether it is the local conditions

sometimes with paralysis of the face limbs and hypoglossal nerve on the opposite side (syndrome of Weber) due to a lesion limited to the inferior internal part of the crus

and treatment -

in the glands which account for the slow development and milder course. The experiments of Arloing would indicate that the virus was attenuated or milder, for he has shown that the caseous material of a lymph-gland killed guinea-pigs, while rabbits escaped. The guinea-pig, as is well known, is the more susceptible animal of the two. The observations of Lingard are still more conclusive, as showing a variation in the virulence of the tubercle bacillus. Guinea-pigs inoculated with ordinary tubercle showed lymphatic infection within the first week, and the animals died within three months; infected with material from scrofulous glands, the lymphatic enlargement did not appear until the second or third week, and the animals survived for six or seven months. He showed, moreover, that the virulence of the infection obtained from the scrofulous glands increased in intensity by passing through a series of guinea-pigs. Eve's experiments show that scrofulous material invariably produces tuberculosis in guinea-pigs and very often in rabbits.

Tuberculous adenitis is met with at all ages. It is more common in children than in adults, but it is not infrequent in the middle period of life, and may occur in old age.

The tubercle bacillus is ubiquitous. All are exposed to infection, and upon the local conditions, whether favorable or unfavorable, depend the fate of those organisms which find lodgment in our bodies. It is possible, of course, that tuberculous adenitis may be congenital, but such instances must be extremely rare. A special predisposing factor in lymphatic tuberculosis is catarrhal inflammation of the mucous membranes, which in itself excites slight adenitis of the neighboring glands. In a child with constantly recurring naso-pharyngeal catarrh, the bacilli which lodge on the mucous membranes find in all probability the gateways less strictly guarded and are taken up by the lymphatics and passed to the nearest glands. In conditions of health the local resistance, or, as some would put it, the phagocytes, would be active enough to deal with the invaders, but the irritation of a chronic catarrh weakens the resistance of the lymph-tissue and the bacilli are enabled to develop and gradually to change a simple into a tuberculous adenitis. The frequent association of tuberculous adenitis of the bronchial glands with whooping-cough and with measles, and the frequent development of tubercle in the mesenteric glands in children with intestinal catarrh, find in this way a rational explanation. After all, as Virchow pointed out, an increased vulnerability of the tissue, however brought about, is the important factor in the disease.

The following are some of the features of interest in tuberculous adenitis:

(*a*) The local character of the disease; thus, the glands of the neck, or at the bifurcation of the bronchi, or those of the mesentery, may be alone involved.

(*b*) The tendency to spontaneous healing. In a large proportion of the cases the battle which ensues between the bacilli and the tissue-cells is

long; but the latter are finally successful, and we find in the calcified remnants in the bronchial and mesenteric lymph-glands evidences of victory. Too often in the bronchial glands a truce only is declared and hostilities may break out afresh in the form of an acute tuberculosis.

(*c*) The tendency of tuberculous adenitis to pass on to suppuration. The frequency with which, particularly in the glands of the neck, we find the tuberculous processes associated with pus is a special feature of this form of adenitis. In nearly all instances the pus is sterile. Whether the suppuration is excited by the bacilli or by their products, or whether it is the result of a mixed infection with pus organisms, which are subsequently destroyed, has not been settled.

(*d*) The existence of an unhealed focus of tuberculous adenitis is a constant menace to the organism. It is safe to say that in three fourths of the instances of acute tuberculosis the infection is derived from this source. On the other hand, it has been urged that scrofula in childhood gives a sort of protection against tuberculosis in adult life. We certainly do meet with many persons of exceptional bodily vigor who in childhood had enlarged glands, but the evidence which Marfan* brings forward in support of this view is not conclusive.

Clinical Forms.—1. **General Tuberculous Lymphadenitis.**—In exceptional instances we find diffuse tuberculosis of nearly all the lymph-glands of the body with little or no involvement of other parts. The most extreme cases of it which I have seen have been in negro patients. Two well-marked cases occurred at the Philadelphia Hospital. In one, a woman, aged thirty-four, was admitted April 4th, with enlarged glands in the right side of the neck and irregular fever. The chart from April, 1888, until March, 1889, showed persistent fever, ranging from 101° to 103°, occasionally rising to 104°. On December 16th the glands on the right side of the neck were removed. After an attack of erysipelas, on February 17th, she gradually sank and died March 5th. The lungs presented only one or two puckered spots at the apices. The bronchial, retro-peritoneal, and mesenteric glands were greatly enlarged and caseous. No intestinal, uterine, or bone disease. The continuous high fever in this case depended apparently upon the tuberculous adenitis, which was much more extensive than was supposed during life. In these instances the enlargement is most marked in the retro-peritoneal, bronchial, and mesenteric glands, but may be also present in the groups of external glands. Occurring acutely, it presents a picture resembling Hodgkin's disease. In a case which died in the Montreal General Hospital this diagnosis was made. The cervical and axillary glands were enormously enlarged, and death was caused by infiltration of the larynx.

2. **Local Tuberculous Adenitis.**—(*a*) *Cervical.*—This is the most common form met with in children. It is seen particularly among the poor

* Archives générales, 1886.

Thus is opposed to Dr Meads opinion that "those persons are most liable to ulcers in the lungs who have strumous swellings in childhood or youth"

In infants & children there is a form of general tuberculous adenitis in which the various groups of glands are successively more rarely individually involved (Lesage & Rosal. Compt. Rend. March 1893) in which death results either from caseation or more acute infection of the meninges.

and those who live continuously in the impure atmosphere of badly ventilated lodgings. Children in foundling hospitals and asylums are specially prone to the disease. In this country it is most common in the negro race. As already stated, it is often met with in catarrh of the nose and throat, or chronic enlargement of the tonsils; or the child may have had eczema of the scalp or a purulent otitis.

The submaxillary glands are first involved, and are popularly spoken of as enlarged *kernels*. They are usually larger on one side than on the other. As they increase in size, the individual tumors can be felt; the surface is smooth and the consistence firm. They may remain isolated, but more commonly they form large, knotted masses, over which the skin is, as a rule, freely movable. In many cases the skin ultimately becomes adherent, and inflammation and suppuration occur. An abscess points and, unless opened, bursts, leaving a sinus which heals slowly. The disease is frequently associated with coryza, with eczema of the scalp, ear, or lips, and with conjunctivitis or keratitis. When the glands are large and growing actively, there is fever. The subjects are usually anæmic, particularly if suppuration has occurred. The progress of this form of adenitis is slow and tedious. Death, however, rarely follows, and many aggravated cases in children ultimately get well. Not only the submaxillary group, but the glands above the clavicle and in the posterior cervical triangle, may be involved. In other instances the cervical and axillary glands are involved together, forming a continuous chain which extends beneath the clavicle and the pectoral muscle. With them the bronchial glands may also be enlarged and caseous. Not infrequently the enlargement of the supraclavicular and axillary group of glands on one side precedes the development of a tuberculous pleurisy or of pulmonary tuberculosis.

(*b*) *Bronchial.*—The mediastinal lymph-glands constitute filters in which lodge the various foreign particles which escape the normal phagocytes of bronchi and lungs. Among these foreign particles, and probably attached to them, tubercle bacilli are not uncommon, and we find tubercles and caseous matter with great frequency in the mediastinal glands, particularly those about the bronchi. It is stated that this process is always secondary to a focus, however small, in the lungs, but my experience does not bear out such a statement. As already mentioned, Northrup found them involved in every one of a hundred and twenty-seven cases at the New York Foundling Hospital. This tuberculous adenitis may, in the bronchial glands, attain the dimensions of a tumor of large size. But even when this occurs there may be no pressure symptoms. In children the bronchial adenitis is apt to be associated with suppuration.

A more serious danger in tuberculous disease of the bronchial glands is systemic infection, which takes place through the vessels. Local infection of the lungs may also occur. In the tuberculous broncho-pneumonia of children it is usual to find the bronchial glands enormously en-

larged, passing deeply into the hilus, adjoining, and in some instances even merging with, areas of caseation of the pulmonary tissue itself.

There is a special danger of infection of the pericardium by tuberculous lymph-glands in the anterior mediastinum.

(*c*) *Mesenteric; Tabes mesenterica.*—In this affection, the abdominal scrofula of old writers, the glands of the mesentery and retro-peritonæum become enlarged and caseate; more rarely they suppurate or calcify. A slight tuberculous adenitis is extremely common in children, and is often accidentally found (post mortem) when the children have died of other diseases. It may be a primary lesion associated with intestinal catarrh, or it may be secondary to tuberculous disease of the intestines.

The primary cases are very common in children, as may be gathered from Woodhead's figures. The general involvement of the glands interferes seriously with nutrition, and the patients are puny, wasted, and anæmic. The abdomen is enlarged and tympanitic; diarrhœa is a constant feature; the stools are thin and offensive. There is moderate fever, but the general wasting and debility are the most characteristic features. The enlarged glands cannot often be felt, owing to the distended condition of the bowels. These cases are often spoken of as consumption of the bowels, but in a majority of them the intestines do not present tuberculous lesions. In a considerable number of the cases of tabes mesenterica the peritonæum is also involved, and in such the abdomen is large and hard, and nodules may be felt. The condition is one to which the French have given the name *carreau.*

In adults tuberculous disease of the mesenteric glands may occur as a primary affection, or in association with pulmonary disease. Gairdner* gives a remarkable instance of the kind in a man aged twenty-one. Instances of this sort are not uncommon in the literature. Large tumors may exist without tuberculous disease in the intestines or in any other parts.

The diagnosis of local and general tuberculous adenitis from lymphadenoma will be subsequently considered.

IV. Pulmonary Tuberculosis (*Phthisis, Consumption*).

Three clinical groups may be conveniently recognized: (1) *tuberculo-pneumonic phthisis*—acute phthisis; (2) *chronic ulcerative phthisis;* and (3) *fibroid phthisis.*

According to the mode of infection there are two distinct types of lesions:

(*a*) When the bacilli reach the lungs through the blood-vessels, the primary lesion is usually in the tissues of the alveolar walls, in the capillary vessels, the epithelium of the air-cells, and in the connective-tissue

* Lectures to Practitioners, Gairdner and Coats, 1888.

framework of the septa. The process of cell division proceeds as already described in the general histology of tubercle. The irritation of the bacilli produces, within a few days, the small, gray miliary nodules, involving several alveoli and consisting largely of round, cuboidal, uninuclear epithelioid cells. Depending upon the number of bacilli which reach the lung in this way, either a localized or a general tuberculosis is excited. The tubercles may be uniformly scattered through both lungs and form a part of a general miliary tuberculosis, or they may be confined to the lungs, or even in great part to one lung. The changes which the tubercles undergo have already been referred to. The further changes may be: (1) Arrest of the process of cell division, gradual sclerosis of the tubercle, and ultimately complete fibroid transformation. (2) Caseation of the centre of the tubercle, extension at the periphery by proliferation of the epithelioid and lymphoid cells, so that the individual tubercles or small groups become confluent and form diffuse areas which undergo caseation and softening. (3) Occasionally as a result of intense infection of a localized region through the blood-vessels the tubercles are thickly set. The intervening tissue becomes acutely inflamed, the air-cells are filled with the products of a desquamative pneumonia, and many lobules are involved.

(*b*) When the bacilli reach the lung through the bronchi—inhalation tuberculosis—the picture differs. The smaller bronchi and bronchioles are more extensively affected; the process is not confined to single groups of alveoli, but has a more lobular arrangement, and the tuberculous masses from the outset are larger, more diffuse, and may in some cases involve an entire lobe or the greater part of a lung. It is in this mode of infection that we see the characteristic peri-bronchial granulations and the areas of the so-called nodular broncho-pneumonia. These broncho-pneumonic areas, with on the one hand caseation, ulceration, and cavity formation, and on the other sclerosis and limitation, make up the essential elements in the anatomical picture of tuberculous phthisis.

1. Acute Pneumonic Phthisis.

This form, known also by the name of galloping consumption, is met with both in children and adults. In the former many of the cases are mistaken for simple broncho-pneumonia.

Two types may be recognized, the *pneumonic* and *broncho-pneumonic*.

(*a*) In the *pneumonic form* one lobe may be involved, or in some instances an entire lung. The organ is heavy, the affected portion airless, the pleura usually covered with thin exudation, and on section the picture resembles closely that of ordinary hepatization. The following is an extract from the post-mortem report of a case in which death occurred twenty-nine days after the onset of the illness, having all the characters of an acute pneumonia: "Left lung weighs 1,500 grammes (double the weight of the

other organ) and is heavy and airless, crepitant only at the anterior margins. Section shows a small cavity the size of a walnut at the apex, about which are scattered tubercles in a consolidated tissue. The greater part of the lung presents a grayish-white appearance due to the aggregation of tubercles which in some places have a continuous, uniform appearance, in others are surrounded by an injected and consolidated lung-tissue. Toward the margins of the lower lobe strands of this firm reddish tissue separate anæmic, dry areas. There are in the right lung three or four small groups of tubercles but no caseous masses. The bronchial glands are not tuberculous." Here the intense local infection was due to the small focus at the apex of the lung, probably an aspiration process.

Only the most careful inspection may reveal the presence of miliary tubercles, or the attention may be arrested by the detection of tubercles in the other lung or in the bronchial glands. The process may involve only one lobe. There may be older areas which are of a peculiarly yellowish-white color and distinctly caseous. The most remarkable picture is presented by cases of this kind in which the disease lasts for some months. A lobe or an entire lung may be enlarged, firm, airless throughout, and converted into a dry, yellowish-white, cheesy substance. Cases are met with in which the entire lung from apex to base is in this condition, with perhaps only a small, narrow area of air-containing tissue on the margin. More commonly, if the case has lasted for two or three months, rapid softening has taken place at the apex. The following brief extract gives the actual condition of the lung in a case in which death occurred in the eleventh week: "Left lung is solid and heavy, weighing 1,490 grammes, and is nowhere crepitant. The upper third of the upper lobe is occupied by a cavity, containing blood and pus, the walls of which are formed by ragged caseous masses. The rest of the lung is firm and solid, and on section presents a uniform opaque white color. The surface is dry, and all parts present the same cheesy appearance."

Symptoms.—The attack sets in abruptly with a chill, usually in an individual who has enjoyed good health, although in many cases the onset has been preceded by exposure to cold, or there have been debilitating circumstances. The temperature rises rapidly after the chill, there are pain in the side, and cough, with at first mucoid, subsequently rusty-colored expectoration. The dyspnœa may become extreme and the patient may have suffocative attacks. The physical examination shows involvement of one lobe or of one lung, with signs of consolidation, dulness, increased fremitus, at first feeble or suppressed vesicular murmur, and subsequently well-marked bronchial breathing. The upper or lower lobe may be involved, or in some cases the entire lung.

At this time, as a rule, no suspicion enters the mind of the practitioner that the case is anything but one of frank lobar pneumonia. Occasionally there may be suspicious circumstances in the history of the patient or in his family; but, as a rule, no stress is laid upon them in comparison

with the intense and characteristic mode of onset. Between the eighth and tenth day, instead of the expected crisis, the condition becomes aggravated, the temperature is irregular, and the pulse more rapid. There may be sweating, and the expectoration becomes muco-purulent. Even in the second or third week, with the persistence of these symptoms, the physician tries to console himself with the idea that the case is one of unresolved pneumonia, and that all will yet be well. Gradually, however, the severity of the symptoms, the presence of physical signs indicating softening, the existence of elastic tissue and tubercle bacilli in the sputa present the mournful proofs that the case is one of acute pneumonic phthisis. Death may occur before softening takes place, even in the second or third week. In other cases there is extensive destruction at the apex, with rapid formation of cavity, and the case may drag on for two or three months.

Diagnosis.—It is by no means widely recognized in the profession that there is a form of acute phthisis which may closely simulate ordinary pneumonia. Waters, of Liverpool, gave an admirable description of these cases, and called attention to the difficulty in distinguishing them from ordinary pneumonia. Certainly the mode of onset affords no criterion whatever. A healthy, robust-looking young Irishman, a cab-driver, who had been kept waiting on a cold, blustering night until three in the morning, was seized the next afternoon with a violent chill, and the following day was admitted to my wards at the University Hospital, Philadelphia. He was made the subject of a clinical lecture on the fifth day, when there was absent no single feature in history, symptoms, or physical signs of acute lobar pneumonia of the right upper lobe. It was not until ten days later, when bacilli were found in his expectoration, that we were made aware of the true nature of the case. I know of no criterion by which cases of this kind can be distinguished in the early stage. The tubercle bacilli are not present at first. A point to which Traube called attention, and which is also referred to as important by Herard and Cornil, is the absence of breath-sounds in the consolidated region; but this, I am sure, does not hold good in all cases. The tubular breathing may be intense and marked as early as the fourth day; and again, how common it is to have, as one of the earliest and most suggestive symptoms of lobar pneumonia, suppression or enfeeblement of the vesicular murmur! In many cases, however, there are suspicious circumstances in the onset; the patient has been in bad health, or may have had previous pulmonary trouble, or there are recurring chills. Careful examination of the sputa and a study of the physical signs from day to day can alone determine the true nature of the case. A point of some moment is the character of the fever, which in true pneumonia is more continuous, particularly in severe cases, whereas in this form of tuberculosis remissions of 1·5° or 2° are not infrequent.

(*b*) *Acute tuberculous broncho-pneumonia* is more common, particu-

larly in children, and forms a majority of the cases of *phthisis florida* or "galloping consumption." It is an acute caseous broncho-pneumonia, starting in the smaller tubes, which become blocked with a cheesy substance, while the air-cells of the lobule are filled with the products of a catarrhal pneumonia. In the early stage the areas have a grayish-red, later an opaque-white, caseous appearance. By the fusion of contiguous masses an entire lobe may be rendered nearly solid, but there can usually be seen between the groups areas of crepitant air tissue. This is not an uncommon picture in the acute phthisis of adults, but it is still more frequent in children. The following is an extract from the post-mortem of a case on a child aged four months, which died in the sixth week of illness: "The upper lobe of the right lung is scarcely anywhere crepitant except at the anterior edge. The middle and lower lobes are heavy and slightly crepitant; the visceral pleura is beset with tubercles which have grown into it from the lung. On section the right upper lobe is occupied with caseous masses from five to twelve millimetres in diameter, separated from each other by an intervening tissue of a deep-red color. The bronchi are filled with cheesy substance. The middle and lower lobes are stuffed with tubercles, many of which are becoming caseous. Toward the diaphragmatic surface of the lower lobe there is a small cavity, the size of a marble. The left lung is more crepitant and uniformly studded with tubercles of all sizes, some as large as peas. There is an acute tuberculous bronchitis in the smaller and larger branches, and extending into the trachea. The bronchial glands are very large, and one contains a tuberculous abscess."

In children the enlarged bronchial glands usually surround the root of the lung, and even pass deeply into the substance, and the lobules are often involved by direct contact.*

In other cases the caseous broncho-pneumonia involves groups of alveoli or lobules in different portions of the lungs, more commonly at both apices, forming areas from one to three centimetres in diameter. The size of the mass depends largely upon that of the bronchus involved. There are cases which probably should come in this category, in which, with a history of an acute illness of from four to eight weeks, the lungs are extensively studded with large gray tubercles, ranging in size from five to ten millimetres. In some instances there are cheesy masses the size of a cherry. All of these are grayish-white in color, distinctly cheesy, and between the adjacent ones, particularly in the lower lobe, there may be recent pneumonia, or the condition of lung which has been termed splenization. In a case of this kind at the Philadelphia Hospital death took place about the eighth week from the abrupt onset of the illness with hæmorrhage. There were no extensive areas of consolidation, but the cheesy nodules were uniformly scattered throughout both lungs. No softening had taken place.

* *Vide* the drawings illustrating Northrup's article; New York Medical Journal, February 21, 1891.

There is a form of tuberculous inspiration broncho-pneumonia, to which Baumler has called special attention, developing as a sequence of haemoptysis, and due to the aspiration of blood and the contents of pulmonary cavities into the finer tubes. Following the haemoptysis, which may have occurred in an individual without suspected lesion, there is fever, dyspnoea, and the signs of a diffuse broncho-pneumonia. Some of the cases run a very rapid course, and are the instances of galloping consumption following haemoptysis. This accident may not only occur early in the disease, but may follow the haemorrhage of well-developed cases.

Symptoms.—The symptoms of acute broncho-pneumonic phthisis are very variable. In adults the disease may attack persons in good health, but who are overworked or "run down" from any cause. Hæmorrhage initiates the attack in a few cases. There may be repeated chills; the temperature is high, the pulse rapid, and the respirations are increased. The loss of flesh and strength is very striking.

The physical signs may at first be uncertain and indefinite, but finally there are areas of impaired resonance, usually at the apices; the breath-sounds are harsh and tubular, with numerous râles. The sputa may early show elastic tissue and tubercle bacilli. In the acute cases, within three weeks, the patient may be in a marked typhoid state, with delirium, dry tongue, and high fever. Death may occur within three weeks. In other cases the onset is severe, with high fever, rapid loss of flesh and strength, and signs of extensive unilateral or bilateral disease. Softening takes place; there are sweats, chills, and progressive emaciation, and all the features of *phthisis florida*. Six or eight weeks or later the patient may begin to improve, the fever lessens, the general symptoms mitigate, and a case which looked as if it would certainly terminate fatally within a few weeks drags on and becomes chronic.

In *children* the disease most commonly follows the infectious diseases, particularly measles and whooping-cough.* The profession is gradually recognizing the fact that a majority of all such cases are tuberculous. At least *three groups* of these cases of tuberculous broncho-pneumonia may be recognized. In the *first* the child is taken ill suddenly while teething or during convalescence from fever; the temperature rises rapidly, the cough is severe, and there may be signs of consolidation at one or both apices with râles. Death may occur within a few days, and the lung shows areas of broncho-pneumonia, with perhaps here and there scattered opaque grayish-yellow nodules. Macroscopically the affection does not look tuberculous, but histologically miliary granulations and bacilli may be found.† Tubercles are usually present in the bronchial glands, but the appearance of the broncho-pneumonia may be exceedingly deceptive, and it may require careful microscopical examination to determine its tuberculous character. The *second group* is represented by the case of the child previously quoted, which died at the sixth week with the ordinary symptoms of severe broncho-pneumonia. And the *third group* is that in which, during the convalescence from an infectious disease, the child is taken ill with fever, cough, and shortness of breath. The severity of the symptoms mitigates within the first fortnight; but there is loss of flesh, the general condition is bad, and the physical examination shows the presence of scattered râles throughout the lungs, and here and there areas of defective resonance. The child has sweats, the fever becomes hectic in

* "Tussis convulsiva vestibulum tabis" (Willis).

† Cornil and Babes, Les Bactéries, tome ii, 1890.

character, and in many cases the clinical picture gradually develops into that of chronic phthisis.

2. Chronic Ulcerative Phthisis.

Under this heading may be grouped the great majority of cases of pulmonary tuberculosis, in which the lesions proceed to ulceration and softening, and ultimately produce the well-known picture of chronic phthisis. At first a strictly tuberculous affection, it ultimately becomes, in a majority of cases, a mixed disease, many of the most prominent symptoms of which are due to septic infection from purulent foci and cavities.

Morbid Anatomy.—Inspection of the lungs in a case of chronic phthisis shows a remarkable variety of lesions, comprising nodular tubercles, diffuse tuberculous infiltration, caseous masses, pneumonic areas, cavities of various size, with changes in the pleura, bronchi, and bronchial glands.

1. **The Distribution of the Lesions.**—For years it has been recognized that the most advanced lesions are at the apices, and that the disease progresses downward, usually more rapidly in one of the lungs. This general statement, which has passed current in the text-books ever since the masterly description of Laennec, has recently been carefully elaborated by Kingston Fowler, who finds that the disease in its onward progress through the lungs follows, in a majority of the cases, distinct routes. In the upper lobe the primary lesion is not, as a rule, at the extreme apex, but from an inch to an inch and a half below the summit of the lung, and nearer to the posterior and external borders. The lesion here tends to spread downward, probably from inhalation of the virus, and this accounts for the frequent circumstance that examination behind, in the supraspinous fossa, will give indications of disease before any evidences exist at the apex in front. Anteriorly this initial focus corresponds to a spot just below the centre of the clavicle, and the direction of extension in front is along the anterior aspect of the upper lobe, along a line running about an inch and a half from the inner ends of the first, second, and third interspaces. A second less common site of the primary lesion in the apex "corresponds on the chest wall with the first and second interspaces below the outer third of the clavicle." The extension is downward, so that the outer part of the upper lobe is chiefly involved.

In the middle lobe of the right lung the affection usually follows the upper lobe on the same side. In the involvement of the lower lobe the first secondary infiltration is about an inch to an inch and a half below the posterior extremity of its apex, and corresponds on the chest wall to a spot opposite the fifth dorsal spine. This involvement is of the greatest importance clinically, as "in the great majority of cases, when the physical signs of the disease at the apex are sufficiently definite to allow of the diagnosis of phthisis being made, the lower lobe is already affected." Ex-

amination, therefore, should be made carefully of this posterior apex in all suspicious cases. In this situation the lesion spreads downward and laterally along the line of the interlobular septa, a line which is marked by the vertebral border of the scapula, when the hand is placed on the opposite scapula and the elbow raised above the level of the shoulder. Once present in an apex, the disease usually extends in time to the opposite upper lobe; but not, as a rule, until the apex of the lower lobe of the lung first affected has been attacked.

Of 427 cases above mentioned, the right apex was involved in 172, the left in 130, both in 111.

Lesions of the base may be primary, though this is rare. Percy Kidd makes the proportion of basic to apicic phthisis one to five hundred, a smaller number than existed in my series. In very chronic cases there may be arrested lesions at the apex and more recent lesions at the base.

2. **Summary of the Lesions in Chronic Ulcerative Phthisis.**—(*a*) *Miliary Tubercles.*—These may not be evident on microscopical examination, or there may be a few colonies, "the secondary crop" of Laennec, about the caseous areas. In other instances, with old lesions at the apex, there are, throughout the lower lobes, scattered groups of miliary tubercles which have undergone fibroid and pigmentary changes. Sometimes, in cases with cavity formation at the apex, the greater part of the lower lobes present many groups of firm, sclerotic, miliary tubercles, which may indeed form the distinguishing anatomical feature—a chronic miliary tuberculosis.

(*b*) *Tuberculous Broncho-pneumonia.*—In a large proportion of the cases of chronic phthisis the terminal bronchiole is the point of origin of the process, consequently we find the smaller bronchi and their alveolar territories blocked with the accumulated products of inflammation in all stages of *caseation.* At an early period a cross-section of an area of tuberculous broncho-pneumonia gives the most characteristic appearance. The central bronchiole is seen as a small orifice, or it is plugged with cheesy contents, while surrounding it is a caseous nodule, the so-called peribronchial tubercle. The longitudinal section has a somewhat dendritic or foliaceous appearance. The condition of the picture depends much upon the slowness or rapidity with which the process has advanced. The following changes may occur:

Ulceration. — When the caseation takes place rapidly or ulceration occurs in the bronchial wall, the mass may break down and form a small cavity.

Sclerosis.—In other instances the process is more chronic. Fibroid changes gradually produce a sclerosis of the affected area, a condition which is sometimes called *cirrhosis nodosa tuberculosa.* The sclerosis may be confined to the margin of the mass, forming a limiting capsule, within which is a uniform, firm, cheesy substance, in which lime salts are often deposited. This represents the healing of one of these areas of caseous

broncho-pneumonia. It is only, however, when complete fibroid transformation or calcification has occurred that we can really speak of healing. In many instances the colonies of miliary tubercles about these masses show that the virus is still active in them. Subsequently, in ulcerative processes, these calcareous bodies — lung-stones, as they are sometimes called—may be expectorated.

(*c*) *Pneumonia.*—An important though secondary place is occupied by inflammation of the alveoli surrounding the tubercles, which become filled with epithelioid cells. The consolidation may extend for some distance about the tuberculous foci and unite them into areas of uniform consolidation. Although in some instances this inflammatory process may be simple, in others it is undoubtedly specific. It is excited by the tubercle bacilli and is a manifestation of their action. It may present a very varied appearance; in some instances resembling closely ordinary red hepatization, in others more homogeneous and infiltrated, the so-called *infiltration tuberculeuse* of Laennec. In other cases the contents of the alveoli undergo fatty degeneration, and appear on the cut surface as opaque white or yellowish-white bodies. In early phthisis much of the consolidation is due to this pneumonic infiltration, which may surround for some distance the smaller tuberculous foci.

(*d*) *Cavities.*—A vomica is a cavity in the lung tissue, produced by necrosis and ulceration. It differs materially from the bronchiectatic form. The process usually begins in the wall of the bronchus in a tuberculous area. Dilatation is produced by retained secretion, and necrosis and ulceration of the wall occur with gradual destruction of the contiguous tissues. By extension of the necrosis and ulceration the cavity increases, contiguous ones unite, and in an affected region there may be a series of small excavations communicating with a bronchus. In nearly all instances the process extends from the bronchi, though it is possible for necrosis and softening to take place in the centre of a caseous area without primary involvement of the bronchial wall. Three forms of cavities may be recognized:

The *fresh ulcerative*, seen in acute phthisis, in which there is no limiting membrane, but the walls are made up of softened, necrotic, and caseous masses. Small vomicæ of this sort, situated just beneath the pleura, may rupture and cause pneumothorax. In cases of acute tuberculo-pneumonic phthisis they may be large, occupying the greater portion of the upper lobe. In the chronic ulcerative phthisis, cavities of this sort are invariably present in those portions of the lung in which the disease is advancing. At the apex there may be a large old cavity with well-defined walls, while at the anterior margin of the upper lobes, or in the apices of the lower lobe, there are recent ulcerating cavities communicating with the bronchi.

Cavities with well-defined walls.—A majority of the cavities in the chronic form of phthisis have a well-defined limiting membrane, the

inner surface of which constantly produces pus. The walls are crossed by trabeculæ which represent remnants of bronchi and blood-vessels. Even the vomicæ with the well-defined walls extend gradually by a slow necrosis and destruction of the contiguous lung tissue. The contents are usually purulent, similar in character to the grayish nummular sputa coughed up by phthisical patients. Not infrequently the membrane is vascular or it may be hæmorrhagic. Occasionally, when gangrene has occurred in the wall, the contents are horribly fœtid. These cavities may occupy the greater portion of the apex, forming an irregular series which communicate with each other and with the bronchi, or the entire upper lobe except the anterior margin may be excavated, forming a thin-walled cavity. In rare instances the process has proceeded to total excavation of the lung, not a remnant of which remains, except perhaps a narrow strip at the anterior margin. In a case of this kind, in a young girl, the cavity held forty fluidounces.

Quiescent Cavities.—When quite small and surrounded by dense cicatricial tissue communicating with the bronchi they form the *cicatrices fistuleuses* of Laennec. Occasionally one apex may be represented by a series of these small cavities, surrounded by dense fibrous tissue. The lining membrane of these old cavities may be quite smooth, almost like a mucous membrane. Cavities of any size do not heal completely.

Cases are often seen in which it has been supposed that a cavity has healed; but the signs of excavation are notoriously uncertain, and there may be pectoriloquy and cavernous sounds with gurgling, resonant râles in an area of consolidation close to a large bronchus.

In the formation of vomicæ the blood-vessels gradually become closed by an obliterating inflammation. They are the last structures to yield and may be completely exposed in a cavity, even when the circulation is still going on in them. Unfortunately, the erosion of a large vessel which has not yet been obliterated is by no means infrequent, and causes profuse and often fatal hæmorrhage. Another common event is the development of aneurisms on the arteries running in the walls of cavities. These may be small, bunch-like dilatations, or they may form cavities the size of a walnut or even larger. Rasmussen, Douglas Powell and others have called attention to their importance in hæmoptysis, under which section they are dealt with more fully.

And finally, about cavities of all sorts, the connective tissue develops and tends to limit the extent. The thickening is particularly marked beneath the pleura, and in chronic cases an entire apex may be converted into a mass of fibrous tissue, enclosing a few small cavities.

(*e*) *Pleura.*—Practically, in all cases of chronic phthisis the pleura is involved. Adhesions take place which may be thin and readily torn, or dense and firm, uniting layers of from two to five millimetres in thickness. This pleurisy may be simple, but in many cases it is tuberculous, and miliary tubercles or caseous masses are seen in the thickened pleural mem-

brane. Pleural effusion is not at all infrequent, either serous, purulent, or hæmorrhagic. Pneumothorax is a common accident.

(*f*) Changes in the *smaller bronchi* control the situation in the early stages of tuberculous phthisis, and play an important *rôle* throughout the disease. The process very often begins in the walls of the smaller tubes and leads to caseation, distention with products of inflammation, and broncho-pneumonia of the lobules. In many cases the visible implication of the bronchus is an extension upward of a process which has begun in the smallest bronchiole. This involvement weakens the wall, leading to bronchiectasis, not an uncommon event in phthisis. The mucous membrane of the larger bronchi, which is usually involved in a chronic catarrh, is more or less swollen, and in some instances ulcerated.

(*g*) The *bronchial glands*, in the more acute cases, are swollen and œdematous. Miliary tubercles and caseous foci are usually present. In cases of chronic phthisis the caseous areas are common, calcification may occur, and not infrequently purulent softening.

(*h*) *Changes in the other Organs.*—Of these, tuberculosis is the most common. In my series of autopsies the brain presented tuberculous lesions in 31, the spleen in 33, the liver in 12, the kidneys in 32, the intestines in 65, and the pericardium in 7. Other groups of lymphatic glands besides the bronchial may be affected—the cervical, the mediastinal, and the retro-peritoneal.

Certain degenerations are common. *Amyloid change* is frequent in the liver, spleen, kidneys, and mucous membrane of the intestines. The *liver* is often the seat of extensive fatty infiltration, which may cause marked enlargement. The *intestinal tuberculosis* occurs in advanced cases and is responsible in great part for the troublesome diarrhœa.

Endocarditis is not very uncommon, and was present in 12 of my post-mortems and in 27 of Percy Kidd's 500 cases. Tubercles may be present on the endocardium, particularly of the right ventricle. As pointed out by Norman Chevers and confirmed by subsequent writers, the subjects of congenital stenosis of the pulmonary orifice very frequently have phthisis.

The *larynx* is frequently involved, and ulceration of the vocal cords and destruction of the epiglottis are not at all uncommon.

Modes of Onset.—We have already seen that tuberculosis of the lungs may occur as the chief part of a general infection, or may set in with symptoms which closely simulate acute pneumonia. In the ordinary type of pulmonary tuberculosis the invasion is gradual and less striking, but presents an extraordinarily diverse picture, so that the practitioner is often led into error. Among the most characteristic of these types of onset are the following: (*a*) *With dyspeptic and anæmic symptoms*, forming a large and important group. The patients may naturally have had feeble digestion. They begin to show marked signs of dyspepsia and become pale, lose flesh, and look chlorotic before any pulmonary symptoms are

manifest. (*b*) *With chills and fever.* This mode of onset is particularly important in malarial regions, as the diagnosis of ordinary intermittent fever is often made, and the nature of the disease entirely overlooked. In Philadelphia it was very common to have patients sent to hospital supposed to be suffering with malaria, who had well-developed signs of pulmonary tuberculosis. (*c*) *Bronchitic onset.* These are the instances which arise in what the patient calls a neglected cold. The patient has perhaps been subject to naso-pharyngeal catarrh, and has been liable to take cold readily; then a bronchial cough develops, which proves intractable. Sometimes the bronchitic symptoms are associated with wheezing, like mild asthma. The development in these instances may be extremely insidious and, without any special aggravation of the general symptoms or increase in the fever, the tuberculous nature of the trouble may be discovered accidentally by the examination of the sputum. (*d*) *Onset with hæmoptysis.* The relation of hæmoptysis to pulmonary tuberculosis will be discussed elsewhere. The hæmoptysis may come on in a condition of robust health, and it occasionally, though rarely, happens that the pulmonary symptoms follow rapidly. In other cases a long interval elapses. Undoubtedly these are cases in which there has been a small localized lesion in the lung which has not produced constitutional disturbance. (*e*) *Pleuritic onset.* This may be a dry pleurisy, developing at the apex or in a scapular region, or in some instances extending generally. It may be acute pleurisy with effusion, or the effusion may have come on insidiously without any acute manifestations. Phthisis developed in a third of ninety cases of pleurisy with effusion, the subsequent history of which was followed by Bowditch. (*f*) *With laryngeal symptoms.* In rare instances huskiness and loss of voice are the symptoms for which the patient seeks advice, and the epiglottis or cords may be involved in a well-characterized tuberculosis before the physical signs in the lungs are at all clear. It is in these instances that the examination of the sputa is of the greatest value.

These represent the usual modes of onset of the ordinary chronic phthisis. It occasionally happens that in an instance with an acute pneumonic onset the severity of the symptoms subsides, and, instead of terminating as a majority of these cases do within ten or twelve weeks, the case drags on and becomes chronic.

Symptoms.—In discussing the symptoms it is usual to divide the disease into three periods: the first embracing the time of the growth and development of the tubercles; the second, in which they soften; and the third, in which there is a formation of cavities. Unfortunately, these anatomical stages can not be satisfactorily correlated with corresponding clinical periods, and we often find that a patient in the third stage with well-marked cavity is in a far better condition and has greater prospects of recovery than a patient in the first stage with diffuse consolidation. It is therefore better perhaps to disregard them altogether.

1. **Local Symptoms.**—*Pain* in the chest may be early and troublesome or absent throughout. It is usually associated with pleurisy, and may be sharp and stabbing in character, and either constant or felt only during coughing. Perhaps the commonest situation is in the lower thoracic zone, though in some instances it is beneath the scapula or referred to the apex. The attacks may recur at long intervals. Intercostal neuralgia occasionally develops in the course of ordinary phthisis.

Cough is one of the earliest symptoms, and is present in the majority of cases from beginning to end. There is nothing peculiar or distinctive about it. At first dry and hacking, and perhaps scarcely exciting the attention of the patient, it subsequently becomes looser, more constant, and associated with a glairy, muco-purulent expectoration. In the early stages of the disease the cough is bronchial in its origin. When cavities have formed it becomes more paroxysmal, and is most marked in the morning or after a sleep. Cough is not a constant symptom, however, and a patient may present himself with well-marked excavation at one apex who will declare that he has had little or no cough. So, too, there may be well-marked physical signs, dulness and moist sounds, without either expectoration or cough. In well-established cases the nocturnal paroxysms are most distressing and prevent sleep. The cough may be of such persistence and severity as to cause vomiting, and the patient becomes rapidly emaciated from loss of food.

Sputum.—This varies greatly in amount and character at the different stages of ordinary phthisis. There are cases with well-marked local signs at one apex, with slight cough and moderately high fever, without from day to day a trace of expectoration. So, also, there are instances with the most extensive consolidation (caseous pneumonia), with high fever, and, as in a recent instance under observation for several months, without enough expectoration to enable an examination for bacilli to be made. In the early stage of pulmonary tuberculosis the sputum is chiefly catarrhal and has a glairy, sago-like appearance, due to the presence of alveolar cells which have undergone the myelin degeneration. There is nothing distinctive or peculiar in this form of expectoration, which may persist for months without indicating serious trouble. The earliest trace of characteristic sputum is seen in the presence of small grayish or greenish-gray purulent masses. These, when coughed up, are always suggestive and should be the portions picked out for microscopical examination. As softening comes on, the expectoration becomes more profuse and purulent, but may still contain a considerable quantity of alveolar epithelium. Finally, when cavities exist, the sputa assume the so-called nummular form; each mass is isolated, flattened, greenish-gray in color, quite airless, and sinks to the bottom when spat into water.

By the microscopical examination of the sputum we determine whether the process is tuberculous, and whether softening has occurred. For *tubercle bacilli* the Ehrlich-Weigert method is the best. Eleven centimetres

of a saturated solution of fuchsin in absolute alcohol is added to one hundred centimetres of the saturated solution of commercial aniline oil (made by shaking up the oil in water and then filtering). This should be made fresh every third or fourth day. A small bit of the sputum is picked out on a needle or platinum wire and spread thin on the top-cover so as to make a uniformly thin layer. The top-cover is slowly dried about a foot above a Bunsen burner. Sufficient of the staining fluid is then dropped upon the top-cover, which is held at a little distance above the flame until the fluid boils. The staining fluid is then washed off in distilled water or put under the tap, decolorized in thirty per cent nitric-acid fluid, again washed off in water, and mounted on the slide. In doubtful cases the long process is used, the cover-slips remaining twenty-four hours in the stain. The bacilli are seen as elongated, slightly curved, red rods, sometimes presenting a beaded appearance. They are frequently in groups of three or four, but the number varies considerably. Only one or two may be found in a preparation, or, in some instances, they are so abundant that the entire field is occupied.

The presence of these bacilli in the sputum is an infallible indication of the existence of tuberculosis.

Sometimes they are found only after repeated examination. They may be abundant early in the disease and are usually numerous in the nummular sputum of the later stages.

Elastic tissue may be derived from the bronchi, the alveoli, or from the arterial coats; and naturally the appearance of the tissue will vary with the locality from which it comes. In the examination for this it is not necessary to boil the sputum with caustic potash. For years I have used a simple plan which was shown to me at the London Hospital by Sir Andrew Clark. This method depends upon the fact that in almost all instances if the sputum is spread in a sufficiently thin layer the fragments of elastic tissue can be seen with the naked eye. The thick, purulent portions are placed upon a glass plate fifteen by fifteen centimetres and flattened into a thin layer by a second glass plate ten by ten centimetres. In this compressed grayish layer between the glass slips any fragments of elastic tissue show on a black background as grayish-yellow spots and can either be examined at once under a low power or the uppermost piece of glass is slid along until the fragment is exposed, when it is picked out and placed upon the ordinary microscopic slide. Fragments of bread and collections of milk-globules may also present an opaque white appearance, but with a little practice they can readily be recognized. Fragments of epithelium from the tongue, infiltrated with micrococci, are still more deceptive, but the microscope at once shows the difference.

The bronchial elastic tissue forms an elongated network, or two or three long, narrow fibres are found close together. From the blood-vessels a somewhat similar form may be seen and occasionally a distinct

sheeting is found as if it had come from the intima of a good-sized artery. The elastic tissue of the alveolar wall is quite distinctive; the fibres are branched and often show the outline of the arrangement of the air-cells. The elastic tissue from bronchus or alveoli indicates extensive erosion of a tube and softening of the lung-tissue.

Another occasional constituent of the sputum is blood, which may be present as the chief constituent of the expectoration in hæmoptysis or may simply tinge the sputum. In chronic cases with large cavities, in addition to bacteria, various forms of fungi may develop, of which the aspergillus is the most important. Sarcinæ may also occur.

The daily amount of expectoration varies. In rapidly advancing cases, with much cough, it may reach as high as five hundred cubic centimetres in the day. In cases with large cavities the chief amount is brought up in the morning. The expectoration of tuberculous patients usually has a heavy, sweetish odor, and occasionally it is fetid, owing to decomposition in the cavities.

Hæmoptysis.—Hæmoptysis is met with either early in the disease, before there are physical signs, or during the course of the affection when there is softening or excavation. A majority of the hæmorrhages believed to be precursory are really due to already existing disease of the lung, and there is no ground whatever for the opinion, so long held, that phthisis can originate directly from hæmoptysis. The blood may be either pure or mixed with sputum. A distinction should be made between these two forms. When the sputa are simply tinged or the blood is admixed, it comes, in all probability, from hyperæmic bronchial mucosa or locally congested areas of lung-tissue; but the brisk hæmorrhage in which the blood comes up in mouthfuls is always due to erosion of vessels, small or large, in the process of softening, or, in the later stages of the disease, comes from the erosion of a branch of the pulmonary artery or from a ruptured aneurism of the pulmonary artery in a cavity. This latter is the most frequent cause of the fatal hæmorrhage in consumption.

Dyspnœa is not a common accompaniment of ordinary phthisis. The greater part of one lung may be diseased and local trouble exist at the other apex without any shortness of breath. Even in the paroxysms of very high fever the respirations may not be much increased. Rapid advance, as of a broncho-pneumonic process, or the development of miliary tubercles throughout the lung, causes great increase in the number of respirations. A degree of dyspnœa leading to cyanosis is almost unknown, apart from extensive invasion of the sound portions by miliary tubercles. One reason why there is so little shortness of breath in phthisis is that there is always a moderate grade of anæmia, and the diminished lung-space is sufficient to supply oxygen to the reduced number of blood-corpuscles.

2. **General Symptoms.**—*Fever.*—To get a correct idea of the temperature range in pulmonary tuberculosis it is necessary, as Ringer pointed

Phthisis at beginning of Richard Morton.

Rather mystical. Don't say

out, to make tolerably frequent observations. The usual 8 A. M. and 8 P. M. record is, in a majority of the cases, very deceptive, giving neither the minimum nor maximum. The former usually occurs between 2 and 6 A. M. and the latter between 2 and 6 P. M.

A recognition of various forms of fever, viz., of tuberculization, of ulceration, and of absorption, emphasizes the anatomical stages of growth, softening and cavity formation; but practically such a division is of little use, as in a majority of cases these processes are going on together.

Fever is the most important initial symptom and throughout the entire course the thermometer is the most trustworthy guide as to the progress of the affection. With pyrexia a patient loses in weight and strength, and the local disease usually progresses. The periods of apyrexia are those of gain in weight and strength and in limitation of the local lesion. It by no means necessarily follows that a patient with tuberculosis has pyrexia. There may be quite extensive disease without coexisting fever. At the moment of writing, I have eighteen instances of chronic phthisis under observation, of whom ten are practically free from fever; but in the early stage, when tubercles are developing and caseous areas are in process of formation and when softening is in progress, fever is a constant symptom. It was present in one hundred consecutive cases at my dispensary service.

Two types of fever are seen—the remittent and the intermittent. These may occur indifferently in the early or in the late stages of the disease or may alternate with each other, a variability which depends upon the fact that phthisis is a progressive disease and that all stages of lesions may be found in a single lung. Special stress should be laid upon the fact, particularly in malarial regions, that tuberculosis may set in with a fever typically intermittent in character—a daily chill, with subsequent fever and sweat. In Montreal, where malaria is practically unknown, this was always regarded as a suggestive symptom; but in Philadelphia and Baltimore, where ague prevails, it is no exaggeration to say that yearly scores of cases of early tuberculosis are treated for ague. These are often cases that pursue a rapid course. The fever of onset—tuberculization—may be almost continuous, with slight daily exacerbations; and at any time during the course of chronic phthisis, if there is rapid extension, the remissions become less marked.

A remittent fever, in which the temperature is constantly above normal but drops two or three degrees toward morning, is not uncommon in the middle and later stages and is usually associated with softening or extension of the disease. Here, too, a simple morning and evening register may give an entirely erroneous idea as to the range of the fever. With breaking down of the lung-tissue and formation of cavities, associated as these processes always are with suppuration and with more or less systemic contamination, the fever assumes a characteristically intermittent or hectic type. For a large part of the day the patient is not only afebrile,

but the temperature is subnormal. In the annexed two-hourly chart, from a case of chronic tuberculosis of the lungs, it will be seen that from 10 P. M. to 8 or 12 A. M., the temperature continuously fell and reached as low as 95°. A slow rise then took place through the late morning and early afternoon hours and reached its maximum between 6 and 10 P. M. As shown in the chart there were in the three days about forty-three hours of pyrexia and twenty-nine hours of apyrexia. The rapid fall of

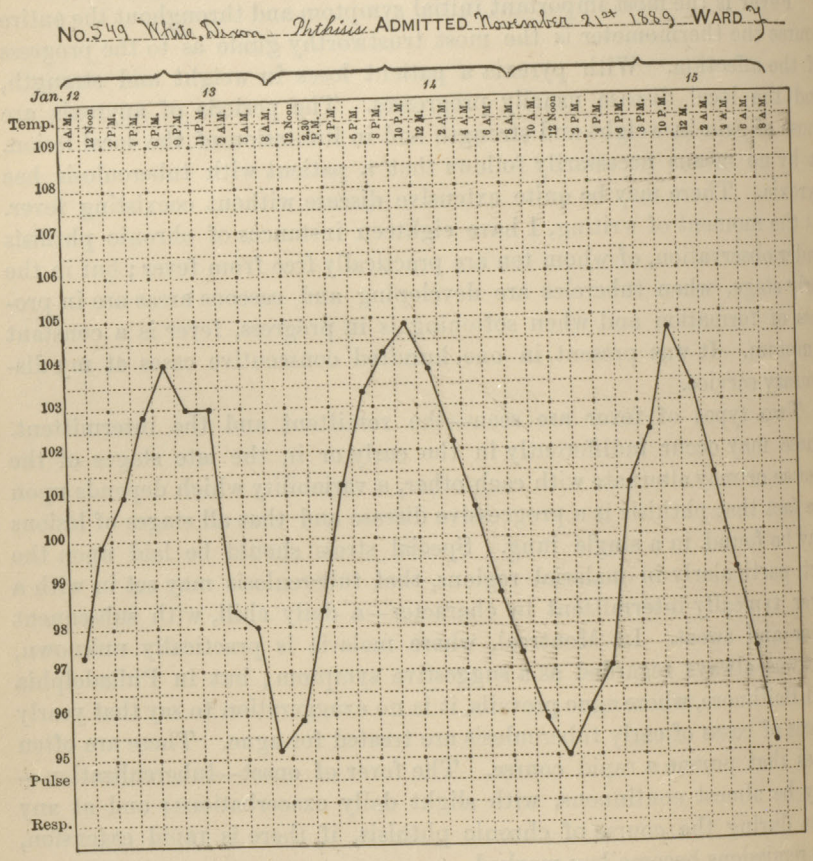


CHART XIII.—Three days. Chronic tuberculosis.

the temperature in the early morning hours is usually associated with sweating. This hectic, as it is called, which is a typical fever of septic infection, is met with when the process of cavity formation and softening is advanced and extending.

A continuous fever with remissions of not more than a degree, developing in the course of pulmonary tuberculosis, is suggestive of acute pneumonia. When a two-hourly chart is made, the remissions even in acute tuberculous pneumonia are usually well marked. A continued fever, such

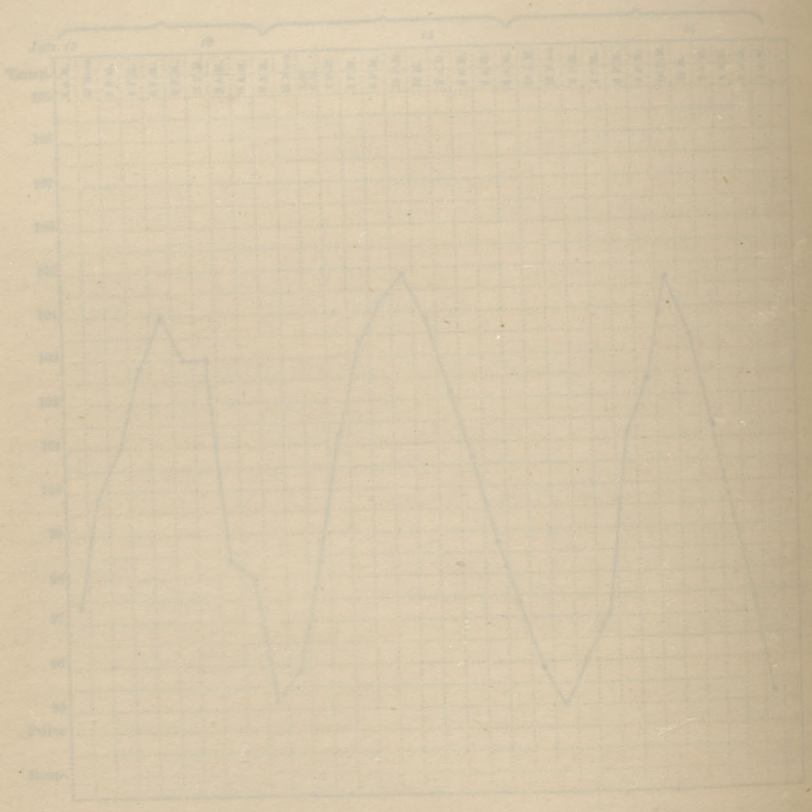


CHART XIII.—Three days. Chronic tuberculosis.

as is seen in the first week of typhoid, or in some cases of inflammation of the lung, is rare in tuberculosis.

Sweating.—Drenching perspirations are common in phthisis and constitute one of the most distressing features of the disease. They occur usually at night, or at any time in the day when the patient sleeps. They may come on early in the disease, but are more persistent and frequent after cavities have formed. Some patients escape altogether.

The *pulse* is increased in frequency, especially when the fever is high. It is often remarkably full, though soft and compressible. Pulsation may sometimes be seen in the capillaries and in the veins on the back of the hand.

Emaciation is a pronounced feature. The loss of weight is gradual but, if the disease is extending, progressive. The scales give one of the best indications of the progress of the case.

3. **Physical Signs.**—(*a*) *Inspection.*—The shape of the chest is often suggestive, though it is to be remembered that pulmonary tuberculosis may be met with in chests of any build. Practically, however, in a considerable proportion of cases the thorax is long and narrow, with very wide intercostal spaces, the ribs more vertical in direction and the costal angle very narrow. The scapulæ are "winged," a point noted by Hippocrates. Another type of chest which is very common is that which is flattened in the antero-posterior diameter. The costal cartilages may be prominent and the sternum depressed. Occasionally the lower sternum forms a deep concavity, the so-called funnel breast (*Trichter-Brust*). Inspection gives valuable information in all stages of the disease. Special examination should be made of the clavicular regions to see if one clavicle stands out more distinctly than the other, or if the spaces above or below it are more marked. Defective expansion at one apex is an early and important sign. The condition of expansion of the lower zone of the thorax may be well estimated by inspection. The condition of the præcordia should also be noted, as a wide area of impulse, particularly in the second, third, and fourth interspaces, often results from disease of the left apex. From a point behind the patient, looking over the shoulders, one can often better estimate the relative expansion of the apices.

(*b*) *Palpation.*—Deficiency in expansion at the apices or bases is perhaps best gauged by placing the hands in the subclavicular spaces and then in the lateral regions of the chest and asking the patient to draw slowly a full breath. Standing behind the patient and placing the thumbs in the supraclavicular and the fingers in the infraclavicular spaces one can judge accurately as to the relative mobility of the two sides. Disease at an apex, though early and before dulness is at all marked, may be indicated by deficient expansion. On asking the patient to count, the tactile fremitus is increased wherever there is local growth of tubercle or extensive caseation. In comparing the apices it is important to bear in mind that normally the fremitus is stronger at the right than

at the left. So too at the base, when there is consolidation of the lung, the fremitus is increased; whereas, if there is pleural effusion, it is diminished or absent. In the later stages, when cavities form, the tactile fremitus is usually much exaggerated over them. When the pleura is greatly thickened the fremitus may be somewhat diminished.

(*c*) *Percussion.*—Tubercles, inflammatory products, fibroid changes, and cavities produce important changes in the pulmonary resonance. There may be localized disease, even of some extent, without inducing much alteration; as when the tubercles are scattered and have air-containing tissue between them. One of the earliest and most valuable signs is defective resonance upon and above a clavicle. In a considerable proportion of all cases of phthisis the dulness is first noted in these regions. The comparison between the two sides should be made also when the breath is held after a full inspiration, as the defective resonance may then be more clearly marked. In the early stages the percussion note is usually higher in pitch and may require an experienced ear to detect the difference. In recent consolidation from caseous pneumonia the percussion note often has a tubular or tympanitic quality. A wooden dulness is rarely heard except in old cases with extensive fibroid change at the apex or base. Over large, thin-walled cavities at the apex the so-called cracked-pot sound may be obtained. In thin subjects the percussion should be carefully practised in the supraspinous fossæ and the interscapular space, as they correspond to very important areas early involved in the disease. In cases with numerous separated cavities at the apex, without much fibroid tissue or thickening of the pleura, the percussion note may show little change, and the contrast between the signs obtained on auscultation and percussion is most marked.

(*d*) *Auscultation.*—Feeble breath-sounds are among the most characteristic early signs, since not as much air enters the tubes and vesicles of the affected area. It is well at first always to compare carefully the corresponding points on the two sides of the chest without asking the patient either to draw a deep breath or to cough. With early apical disease the inspiration on quiet breathing may be scarcely audible. Expiration is usually prolonged. On the other hand there are cases in which the earliest sign is a harsh, rude, respiratory murmur. On deep breathing it is frequently to be noted that inspiration is jerking or wavy, the so-called "cog-wheel" rhythm; which, however, is by no means confined to tuberculosis. With extension of the disease the inspiratory murmur is harsh, and, when consolidation occurs, whiffing and bronchial. With these changes in the character of the murmur there are râles, due to the accompanying bronchitis. They may be heard only on deep inspiration or on coughing, and early in the disease are often crackling in character. When softening occurs they are louder and have a bubbling, sometimes a characteristic clicking quality. These "moist sounds," as they are called, when associated with change in the percussion resonance are extremely suggestive.

When cavities form, the râles are louder, more gurgling, and resonant in quality. When there is consolidation of any extent the breath-sounds are tubular, and in the large excavations loud and cavernous, or have an amphoric quality. In the unaffected portions of the lobe and in the opposite lung the breath-sounds may be harsh and even puerile. The vocal resonance is usually increased in all stages of the process, and bronchophony and pectoriloquy are met with in the regions of consolidation and over cavities. Pleuritic friction may be present at any stage and, as mentioned before, occurs very early. There are cases in which it is a marked feature throughout. When the lappet of lung over the heart is involved there may be a pleuro-pericardial friction, and when this area is consolidated there may be curious clicking râles synchronous with the heart-beat, due to the compression by the heart of, and the expulsion of air from, this portion. An interesting auscultatory sign, met most commonly in phthisis, is the so-called cardio-respiratory murmur, a whiffing systolic bruit due to the propulsion of air out of the tubes by the impulse of the heart. It is best heard during inspiration and in the antero-lateral regions of the chest.

A systolic murmur is frequently heard in the subclavian artery on either side, the pulsation of which may be very visible. The murmur is in all probability due to pressure on the vessels by the thickened pleura.

The signs of cavity may be here briefly enumerated.

(*a*) When there is not much thickening of the pleura or condensation of the surrounding lung-tissue, the percussion sound may be full and clear, resembling the normal note. More commonly there is defective resonance or a tympanitic quality which may at times be purely amphoric. The pitch of the percussion note changes over a cavity when the mouth is opened or closed (Wintrich's sign), or it may be brought out more clearly on change of position. The cracked-pot sound is only obtainable over tolerably large cavities with thin walls. It is best elicited by a firm, quick stroke, the patient at the time having the mouth open. In those rare instances of almost total excavation of one lung the percussion note may be amphoric in quality. (*b*) On auscultation the so-called cavernous sounds are heard: (1) Various grades of modified breathing—blowing or tubular, cavernous or amphoric. There may be a curiously sharp hissing sound, as if the air was passing from a narrow opening into a wide space. In very large cavities both inspiration and expiration may be typically amphoric. (2) There are coarse bubbling râles which have a resonant quality, and on coughing may have a metallic or ringing character. On coughing they are often loud and gurgling. In very large thin-walled cavities, and more rarely in medium-sized cavities, surrounded by recent consolidation, the râles may have a distinctly amphoric echo, simulating those of pneumothorax. There are dry cavities in which no râles are heard. (3) The vocal resonance is greatly intensified and whispered pectoriloquy is clearly heard. In large apical cavities the heart-sounds are well heard, and occasionally there may be an intense systolic murmur,

probably always transmitted to, and not produced, as has been supposed, in the cavity itself.

Pseudo-cavernous signs may be caused by an area of consolidation near a large bronchus. The condition may be most deceptive—the high-pitched or tympanic percussion note, the tubular or cavernous breathing, and the resonant râles, simulate closely those of cavity.

4. **Symptoms referable to other Organs.**—(*a*) *Cardio-vascular.*—The retraction of the left upper lobe exposes a large area of the heart. In thin-chested subjects there may be pulsation in the second, third, and fourth interspaces close to the sternum. Sometimes with much retraction of the left upper lobe the heart is drawn up. A systolic murmur over the pulmonary area is common in all stages of phthisis. Apical murmurs are also not infrequent and may be extremely rough and harsh without necessarily indicating that endocarditis is present. The association of heart-disease with phthisis is not, however, very uncommon. As already mentioned, there were twelve instances of endocarditis in 216 autopsies. The arterial tension is usually low in phthisis and the capillary resistance lessened so that the pulse is often full and soft even in the later stages of the disease. The capillary pulse is not infrequently met with, and pulsation of the veins in the back of the hand is occasionally to be seen.

(*b*) *Blood Glandular System.*—The early anæmia has already been noted. It is often more apparent than real, a chloro-anæmia, and the blood-count rarely sinks below two million per cubic millimetre.

The blood-plates are, as a rule, enormously increased and are seen in the withdrawn blood as the so-called Schultze's granule masses.

(*c*) *Gastro-intestinal System.*—The tongue is usually furred, but may be clean and red. Small aphthous ulcers are sometimes distressing. A red line on the gums, a symptom to which at one time much attention was paid as a special feature of phthisis, occurs in other cachectic states. Extensive tuberculous disease of the pharynx, associated with similar affection of the larynx, may interfere seriously with deglutition and prove a very distressing and intractable symptom.

Of late, special attention has been paid to the gastric symptoms of this affection. Tuberculous disease is rare. I have seen but one undoubted specimen from a case which Musser has reported.* Ulceration may occur as an accidental complication and multiple catarrhal ulcers are not uncommon. Interstitial and parenchymatous changes in the mucosa are common (possibly associated with the venous stasis) and lead to atrophy, but these cannot always be connoted with the symptoms, and they may be found when not expected. On the other hand, when the gastric symptoms have been most persistent, the mucosa may show very little change. It is impossible always to refer the anorexia, nausea, and vomiting of consumption to local conditions. The hectic fever and the neurotic influ-

* Philadelphia Hospital Reports, vol. i, 1890.

ences, upon which Immermann lays much stress, must be taken into account, as they play an important *rôle*. The organ is often dilated, and to muscular insufficiency alone may be due some of the cases of dyspepsia. The condition of the gastric secretion is not constant, and the reports are discordant. In the early stages there may be hyperacidity; later, a deficiency of acid.

Anorexia is often a marked symptom at the onset; there may be positive loathing of food, and even small quantities cause nausea. Sometimes without any nausea or distress after eating the feeding of the patient is a daily battle. When practicable, Debove's forced alimentation is of great benefit in such cases. Nausea and vomiting, though occasionally troublesome at an early period, are more marked in the later stages. The latter may be caused by the severe attacks of coughing. S. H. Habershon refers to four different causes the vomiting in phthisis: (1) central, as from tuberculous meningitis; (2) pressure on the vagi by caseous glands; (3) stimulation from the peripheral branches of the vagus, either pulmonary, pharyngeal, or gastric; and (4) mechanical causes.

Of the *intestinal* symptoms diarrhœa is the most serious. It may come on early, but is more usually a symptom of the later stages, and is associated with ulceration, particularly of the large bowel. Extensive ulceration of the ileum may exist without any diarrhœa. The associated catarrhal condition may account in part for it, and in some instances the amyloid degeneration of the mucous membrane.

(*d*) *Nervous System.*—(1) Focal lesions due to the development of coarse tubercles and areas of tuberculous meningo-encephalitis. Aphasia, for instance, may result from the growth of meningeal tubercles in the fissure of Sylvius, or even hemiplegia may develop. The solitary tubercles are more common in the chronic phthisis of children. (2) Basilar meningitis is an occasional complication. It may be confined to the brain, though more commonly it is a (3) cerebro-spinal meningitis, which may come on in persons without well-developed local signs in the chest. Twice have I known strong, robust men brought into hospital with signs of cerebro-spinal meningitis, in whom the existence of pulmonary disease was not discovered until the post-mortem. (4) Peripheral neuritis. This is not frequent, and has occurred but five times in the large number of consumptives who have come under my observation during the past seven years. It is nearly always an extensor paralysis of the arm or leg, more commonly the latter, causing foot-drop. It is usually a late manifestation. (5) Mental symptoms. It was noted, even by the older writers, that consumptives had a peculiarly hopeful temperament, and the *spes phthisica* forms a curious characteristic of the disease. Patients with extensive cavities, high fever, and too weak to move will often make plans for the future and confidently expect to recover.

Apart from tuberculosis of the brain, there is sometimes in chronic phthisis a form of insanity not unlike that which develops in the conva-

lescence from acute affections. The whole question of the mutual relations of insanity and phthisis is dealt with at length in Mickle's Gulstonian lectures.

(*e*) A remarkable hypertrophy of the mammary gland may occur in pulmonary tuberculosis,* most commonly in males. It may only be on the affected side. Two cases came under my notice at the University Hospital, Philadelphia, both in young males. It is a chronic interstitial, non-tuberculous mammitis (Allot).

(*f*) *Genito-urinary System.*—The urine presents no special peculiarities in amount or constituents. Fever, however, has a marked influence upon it. Albumen is met with frequently and may be associated with the fever, or is the result of definite changes in the kidneys. In the latter case it is more abundant and more curd-like. Amyloid disease of the kidneys is not uncommon. Its presence is shown by albumen and tube-casts in the urine, and sometimes by a great increase in the amount of urine. In other instances there is dropsy, and the patients have all the characteristic features of chronic Bright's disease.

Pus in the urine may be due to disease of the bladder or of the pelves of the kidneys. In some instances the entire urinary tract is involved. In pulmonary phthisis, however, extensive tuberculous disease is rarely found in the urinary organs. Bacilli may occasionally be detected in the pus. Hæmaturia is not a very common symptom. It may occur occasionally as a result of congestion of the kidneys, which passes off and leaves the urine albuminous. In other instances it results from disease of the pelvis or of the bladder, and is associated either with early tuberculosis of the mucous membranes or more commonly with ulceration.

(*g*) *Cutaneous System.*—The skin is often dry and harsh. Local tubercles occasionally develop on the hands. There may be pigmentary staining, the *chloasma phthisicorum*, which is more common when the peritonæum is involved. Upon the chest and back the brown stains of the *pityriasis versicolor* are very frequent. The hair of the head and beard may become dry and lanky. The terminal phalanges, in chronic cases, become clubbed and the nails incurvated—the Hippocratic fingers.† A remarkable and unusual complication is general emphysema, which may result from ulceration of an adherent lung or perforation of the larynx.

Diagnosis.—When well advanced there is rarely any doubt as to the existence of tuberculous phthisis, for the sputum gives positive information, and the physical signs of local disease are well marked. The bacilli give an infallible indication of the existence of tuberculosis and may be found in the sputum before the physical signs are at all definite. On the other hand, it must be remembered that there are cases in which, even

* Allot, Paris Thesis, 1887.

† "Morbo progrediente, corpus macrescit præter crura: hæc autem tument et pedes, et ungues contorquentur" (Hippocrates).

with tolerably well-defined physical signs, the sputum is extremely scanty and many examinations may be required to detect tubercle bacilli. So essential is the examination of the sputum in the early diagnosis of phthisis that I would earnestly insist upon the more frequent employment of this method. There is no excuse now for its omission, since, if the practitioner has not command of the necessary technique, there are laboratories in many parts of the country at which the examination can be made. *Early detection is of vital importance, as successful treatment depends upon the measures taken before the lung is extensively involved.*

The presence of elastic fibres in the sputum is an indication of destruction of the lung-tissue. In a large proportion of cases it is indicative, too, of tuberculous disease. It also may be found early, before the physical signs are well marked. Its detection is easy by the above-mentioned method, not requiring high powers of the microscope. In cases of early hæmoptysis, before there is marked constitutional disturbance, or even local signs, it is very important to make a thorough examination of the sputum, from which mucoid and purulent portions may be picked out for examination. With localized and persistent signs in one lung, cough, fever, and loss of flesh, the diagnosis is rarely dubious. It is remarkable, however, to what an extent the local process may sometimes proceed without disturbance of health sufficient to excite the alarm of the physician or friends. There are puzzling cases with localized physical signs at one apex, chiefly moist râles, rarely any percussion changes, perhaps slight fever, and a glairy expectoration containing numerous alveolar cells. I have seen several cases of this kind which have been for a time very obscure, and in which repeated examinations failed to detect either bacilli or elastic tissue. They seem to be instances of local catarrhal trouble in the smaller tubes, some of which clear in a few weeks.

3. Fibroid Phthisis.

In the section on diseases of the lungs we shall refer to the chronic interstitial pneumonia, or cirrhosis of the lung, which may be a sequence of acute lobar pneumonia, or follow a chronic pleurisy, or is due to inhalation of dust, as in anthracosis. From these causes a condition of sclerosis or induration of the lung may be produced with gradual shrinkage. An identical condition is present in certain cases of chronic pulmonary tuberculosis, and to this it is best perhaps to limit the term *fibroid phthisis*. This form may come on gradually as a sequence of a chronic tuberculous broncho-pneumonia, or follow a chronic tuberculous pleurisy. In other instances the process supervenes upon an ordinary ulcerative phthisis. The disease becomes limited to one apex, the cavity is surrounded by layers of dense fibrous tissue, the pleura is thickened, and the lower lobe is gradually invaded by the sclerotic change. Ultimately a picture is produced little if at all different from the other forms of cirrhosis of the

lungs. It may even be difficult to say that the process is tuberculous, but in advanced cases the bacilli are usually present in the walls of the cavity at the apex, or old, encapsulated caseous areas exist in the lung, or there may be tubercles at the apex of the other lung and in the bronchial glands. Dilatation of the bronchi is present; the right ventricle, sometimes the entire heart, is hypertrophied.

The disease is chronic, lasting from ten to twenty or more years, during which time the patient may have fair health.

The chief symptoms are cough, which is often paroxysmal in character and most marked in the morning. The expectoration is purulent, and in some instances, when the bronchiectasis is extensive, fœtid. There is dyspnœa on exertion, but little or no fever.

The physical signs are very characteristic. The chest is sunken and the shoulder lower on the affected side; the heart is often drawn over and displaced. If the left lung is involved there may be an unusually large area of cardiac pulsation in the third, fourth, and fifth interspaces. Heart-murmurs are common. There is dulness over the affected side and deficient tactile fremitus. At the apex there may be well-marked cavernous sounds; at the base, distant bronchial breathing. The condition may persist indefinitely. In some cases the other lung becomes involved, or the patient has repeated attacks of hæmoptysis, in one of which he dies. As a result of the chronic suppuration, amyloid degeneration of the liver, spleen, and intestines may take place; dropsy frequently supervenes from failure of the right heart.

A more detailed account is found under Cirrhosis of the Lung, with which this form is clinically identical.

Diseases associated with Pulmonary Tuberculosis.

Lobar pneumonia is not an uncommon cause of death. It is met with most frequently, indeed, as a terminal event in the chronic cases. It may, however, occur early, and be difficult to distinguish from an acute caseous pneumonia. The sputa in the latter are rarely rusty, while the fever in the former is more continuous and higher, but in many cases it is impossible to differentiate between the two conditions.

Typhoid fever is rare in phthisis, but cases unquestionably occur. In *Case 8* of my series of post-mortems in this disease, a girl, aged eighteen, had peritoneal adhesions, local disease at both apices, and perfectly characteristic enteric lesions. In *Case 34*, a male, aged twenty-five, with tuberculous cavities, had a very acute attack. The Peyer's glands were greatly swollen with adherent sloughs. The spleen weighed 533 grammes. The characters of the ulceration are usually distinctive.

Erysipelas not infrequently attacks old *poitrinaires* in hospital wards and almshouses. There are instances in which the attack seems to be beneficial, as the cough lessens and the symptoms ameliorate. It may, however, prove fatal, as in a recent case admitted to my wards.

Heart disease. I have already (p. 218) referred to the occurrence of endocarditis in tuberculosis. The antagonism between the two conditions in which Rokitansky found fibrosis is not personal fibrosis of the pulmonary artery and aneurysm of the aorta predisposed to tuberculosis, probably by reducing the activity of the pulmonic circulation. In mitral stenosis pulmonary tuberculosis is not infrequent - in 9 of 54 cases (Potain). The mitral lesion may in some instances be secondary to the lung disease.

The *eruptive fevers*, particularly measles, frequently precede, but rarely develop in the course of pulmonary tuberculosis. In the revaccination of a tuberculous subject the vesicles run a normal course.

Fistula in ano is associated with phthisis in an interesting manner. In a majority of such cases it is a tuberculous process. The general affection may progress rapidly after an operation. The question is considered in tuberculosis of the alimentary canal.

In chronic and arrested phthisis *arterio-sclerosis* is not uncommon. Ormerod noted thirty cases of chronic renal disease in one hundred post mortems.

The association of tuberculosis with *chronic arthritis*, upon which certain writers lay stress, finds its explanation in the lowered resistance of these patients, and the greater liability to infection in the institutions in which so many of them live.

Peculiarities of Pulmonary Tuberculosis at the Extremes of Life.

(*a*) *Old Age.*—It is remarkable how common tuberculosis is in the aged, particularly in institutions. McLachlan noted a hundred and forty-five cases in which tuberculosis was the cause of death in old persons in Chelsea Hospital. All were over sixty years of age. The experience at Salpêtrière is the same. Laennec met with a case in a person over ninety-nine years of age.

At the Philadelphia Hospital, in the bodies of aged persons sent over from the almshouse it was extremely common to find either old or recent tuberculosis. A patient died under my care at the age of eighty-two with extensive peritoneal tuberculosis. Pulmonary tuberculosis in the aged is usually latent and runs a slow course. The physical signs are often masked by emphysema and by the coexisting chronic bronchitis. The diagnosis may depend entirely upon the discovery of the bacilli and elastic tissue. Contrary to the opinion which was held some years ago, tuberculosis is by no means uncommon with senile emphysema. Some of the cases of tuberculosis in the aged are instances of quiescent disease which may have dated from an early period.

(*b*) *Infants.*—The occurrence of acute tuberculosis in children has already been mentioned, and also the fact that the disease is occasionally congenital. Recent studies, particularly of French writers, have shown that it is a frequent affection in children under two years of age. Leroux has analyzed the statistics of the late Prof. Parrot, embracing 219 cases in children under three years. Of these there were from one day to three months, 23; from three to six months, 35; from six to twelve months, 53 (a total of 111 under one year); and from one to two years, 108. Pulmonary cavities were present in 57 of the cases, and in only 50 was the pulmonary lesion the sole manifestation. At the St. Petersburg Foundling Asylum, in the ten years ending 1884, there were 416 cases of tuberculosis in 16,581 autopsies. The observations of Northrup, at the New

York Foundling Hospital, are of special interest in connectien with the mode of infection. Of 125 cases of tuberculosis on the records of this institution, in 34 the ravages were extensive, the seat of the primary affection was not clear, and the bronchial glands were large and cheesy. In 20 cases of general tuberculosis there were cheesy masses in the bronchial glands and in the lungs. In 42 cases of general tuberculosis the only cheesy masses were in the bronchial lymph-glands. In 9 cases the tubercles were limited to the bronchial nodes and the lungs; the latter containing only discrete miliary bodies, while the bronchial glands were in advanced caseation. In 13 cases there was tuberculosis of the bronchial nodes only. In most of these cases the patients died of infectious diseases. These figures are very suggestive, and point, as already noted, to infection through the bronchial passages as the most common method, even in children. Of 500 autopsies in children at the Munich Pathological Institute, in 150 (thirty per cent) tuberculosis was present and in over ninety-two per cent the lungs were involved (Müller).

Modes of Death in Pulmonary Tuberculosis.

(*a*) *By asthenia*, a gradual failure of the strength. The end is usually peaceable and quiet,* occasionally disturbed by paroxysms of cough. Consciousness is often retained until near the close.

(*b*) *By asphyxia*, as in some cases of acute miliary tuberculosis and in acute pneumonic phthisis. In chronic phthisis it is rarely seen, even when pneumothorax develops.

(*c*) *By syncope.* This is not common. I have known it to happen once or twice in patients who insisted upon going about when in the advanced stages of the disease. There may be, but not necessarily, fatty degeneration of the heart. A rapidly developing syncope may follow hæmorrhage or may be due to thrombosis or embolism of the pulmonary artery, or to pneumothorax.

(*d*) *From hæmorrhage.* The fatal bleeding in chronic phthisis is due to erosion of a large vessel or rupture of an aneurism in the pulmonary cavity, most commonly the latter. Of twenty-six analyzed by S. West, in eleven cases the fatal hæmoptysis was due to aneurism, and of thirty-five cases collected by Percy Kidd, aneurism was present in thirty. In a case of Curtin's, at the Philadelphia Hospital, the bleeding proved fatal before hæmoptysis occurred, as the eroded vessel opened into a capacious cavity.

(*e*) *With cerebral symptoms.* Coma may be due to meningitis, less often to uræmia. Death in convulsions is rare. The hæmorrhagic pachymeningitis which develops in some cases of phthisis occasionally causes loss of consciousness, but is rarely a direct cause of death. In one of my

* As is so well described by Sir Thomas Browne, whose *Letter to a Friend* gives a unique account of the last illness of a consumptive. Hood's *Death-bed* is true of phthisis more frequently than of any other disease.

cases, death resulted from thrombosis of the cerebral sinuses with symptoms of meningitis.

V. Tuberculosis of the Serous Membranes.

General Pleuro-peritoneal Tuberculosis.—There are interesting cases in which the lesions are confined almost entirely to the serous sacs—the pleura, pericardium, and peritonæum. I do not here refer to instances of chronic pulmonary tuberculosis, in which the pleura and the peritonæum may be involved, but to the primitive form, in which these serous membranes are involved in either (*a*) *an acute miliary inflammation;* (*b*) *a chronic ulcerative tuberculosis;* or (*c*) *a chronic fibroid tuberculosis.* It is sufficient to indicate here the fact that cases occur involving primarily the pleura and peritonæum alone, sometimes with the pericardium, and to pass on to the consideration of the affections of the individual sacs.

Tuberculosis of the Pleura.—This may be primary or secondary.

Primary tuberculosis of the pleura occurs as an *acute* process associated with a sero-fibrinous or hæmorrhagic exudate. Unquestionably many of the cases regarded as pleurisy from cold are of this nature. It may be truly primary, but in many instances local tuberculous disease exists in lung or lymph-glands. There is a primary chronic tuberculosis of the pleura. This produces great thickening and caseation of both layers, which are separated from each other by a thin infiltrated connective tissue, in which miliary granulations may sometimes be seen. The pleural layers together may have a thickness of from five to ten millimetres. It is a comparatively rare affection. I found one of the most striking illustrations of the kind in a young, remarkably healthy-looking Irish girl, who died under my care of malignant scarlet fever. There were no other tuberculous lesions in the body. The condition may be unilateral or bilateral.

Secondary tuberculous pleurisy is very common. The visceral layer is always involved in pulmonary tuberculosis. Adhesions usually form and a chronic pleurisy results, which may be simple, but usually tubercles are scattered through the adhesions. An acute tuberculous pleurisy may result from direct extension. The fluid may be sero-fibrinous or hæmorrhagic, or may become purulent. And, lastly, a very common event in pulmonary tuberculosis is the perforation of a superficial spot of softening, and the production of *pyo-pneumothorax.*

The general symptomatology of these forms will be considered under diseases of the pleura.

Tuberculosis of the Pericardium.—Miliary tubercles may occur as a part of a general infection, but the term is properly limited to those cases in which, either as a primary or secondary process, there is extensive disease of the membrane. Tuberculosis is not so common in the pericardium as in the pleura and peritonæum, but it is certainly more com-

mon than the literature would lead us to suppose. Only thirty references are noted in the Index Catalogue of the Surgeon-General's Office. It occurs in two forms—chronic and acute.

(*a*) *Chronic Tuberculous Pericarditis.*—This may occur as a primary affection associated only with the caseation of the bronchial or particularly the anterior mediastinal lymph-glands. More commonly there is tuberculous disease elsewhere, either of the pleura or of the lungs, sometimes of the peritonæum. In a number of cases the pericarditis is only a part of a general infection of the serous membranes. The instances are very rare in which the process is confined to the pericardium. In one of my cases, a man aged seventy-two, who died of pneumonia in the Philadelphia Hospital, the pericardium was thickened, both leaves were adherent and presented cheesy masses and gray nodules. The heart weighed 554 grammes; the bronchial glands were calcified; there were no tubercles in the other organs. The disease occurs at all ages. My youngest case was in a child, aged five, in whom both layers of the pericardium were greatly thickened and cheesy. In nearly every instance the bronchial or mediastinal glands are tuberculous. Occasionally it is due to extension from tuberculous disease of the sternum or of the spine; occasionally to extension from the lungs. In one case, a man, aged fifty, who died in the Philadelphia Hospital, the outer layer of the pericardium was alone involved and thickened, in connection with a tuberculous abscess in the anterior mediastinum. The condition is usually unsuspected. The physical signs are those of hypertrophy of the heart. In a recent case the organ weighed 600 grammes, and the clinical symptoms were those of hypertrophy and dilatation.

The *physical signs* are somewhat uncertain, since they are those of adherent pericardium. The dulness may reach high along the left sternal margin, and in one case, in which it was as high as the middle of the manubrium, the thickened pericardial layers formed a solid cheesy mass which surrounded the aorta.

(*b*) *Acute Tuberculous Pericarditis.*—This may occur as a secondary infection from tubercle in other parts, or it may arise by direct extension from the lungs, or more commonly by invasion from mediastinal lymph-glands. The exudation may be limited in amount and chiefly fibrinous, or it may be serous, and in many cases is hæmorrhagic. Unless carefully sought for, the tubercles may be overlooked. Lastly, some of the cases of purulent pericarditis are tuberculous. The membranes may be much thickened and no trace of tubercles apparent. The nature of the case may, then, be gathered chiefly from the existence of tuberculous bronchial or mediastinal glands, or the existence of tuberculous foci in other regions. The effusion in these cases may be enormous, as in one reported by Musser, in which the sac contained sixty-four ounces of fluid.

The symptoms and physical signs of this condition will be considered with those of ordinary pericarditis with effusion.

(*d*) **Tuberculosis of the Peritonæum.**—In connection with miliary and chronic pulmonary tuberculosis it is not uncommon to find the peritonæum studded with small gray granulations. They are constantly present on the serous surface of tuberculous ulcers of the intestines. Apart from these conditions the membrane is often the seat of extensive tuberculous disease, which occurs in the following forms:

(1) *Acute miliary tuberculosis* with sero-fibrinous or bloody exudation.

(2) *Chronic tuberculosis*, characterized by larger growths, which tend to caseate and ulcerate. It may lead to perforation of the intestinal coils. The exudate is purulent or sero-purulent, and is often sacculated.

(3) *Chronic fibroid tuberculosis*, which may be subacute from the onset, or which may represent the final stage of an acute miliary eruption. The tubercles are hard and pigmented. There is little or no exudation, and the serous surfaces are matted together by adhesions.

The process may be primary and local, which was the case in five of my seventeen post-mortems. In children the infection appears to pass from the intestines, and in adults this is the source in the cases associated with chronic phthisis. In women the disease extends commonly from the Fallopian tubes. In at least 30 or 40 per cent of the instances of laparotomy in this affection reported by gynæcologists the infection was from them. The prostate or the seminal vesicles may be the starting-point. In many cases the peritonæum is involved with the pleura and pericardium, particularly with the former membrane.

It is generally stated that males are attacked oftener than females. In my own series of 21 cases, 15 were males. The recent laparotomies, however, which have been performed in this disease have been chiefly in females; so that in the collected statistics I find the cases to be twice as numerous in females as in males; in the ratio, indeed, of 131 to 60.

Tuberculous peritonitis occurs at all ages. It is common in children associated with intestinal and mesenteric disease. The incidence is most frequent between the ages of twenty and forty. It may occur in advanced life. In one of my cases the patient was eighty-two years of age. Of 357 cases collected from the literature,* there were under ten years, 27; between ten and twenty, 75; from twenty to thirty, 87; between thirty and forty, 71; from forty to fifty, 61; from fifty to sixty, 19; from sixty to seventy, 4; above seventy, 2. In America it is more common in the negro than in the white race.

Symptoms.—In certain special features the tuberculous varies considerably from other forms of peritonitis. It presents a symptom-complex of extraordinary diversity.

In the first place, the process may be *latent* and not cause a single symptom. Such are the cases met with accidentally in the operation for

* Johns Hopkins Hospital Reports, vol. ii.

hernia or for ovarian tumor. In direct contrast are the instances in which the onset is so sudden and violent that the diagnosis of *enteritis* or *hernia* is made. The operation for strangulated hernia has, indeed, been performed. Many cases set in acutely with fever, abdominal tenderness, and the symptoms of ordinary acute peritonitis. Cases with a slow onset, abdominal tenderness, tympanites, and low continuous fever resemble *typhoid fever* very closely, and may lead to error in diagnosis.

Ascites is frequent, but the effusion is rarely large. It is sometimes hæmorrhagic. It may simulate the effusion in cirrhosis of the liver, of which disease it is to be noted that tuberculous peritonitis is often a final complication. *Tympanites* may be present in the very acute cases, when it is due to loss of tone in the intestines, owing to inflammatory infiltration; or it may occur in the old, long-standing cases when universal adhesion has taken place between the parietal and visceral layers. *Fever* is a marked symptom in the acute cases, and the temperature may reach 103° or 104°. In many instances the fever is slight. In the more chronic cases subnormal temperatures are common, and for days the temperature may not rise above 97°, and the morning temperature may be as low as 95·5°. An occasional symptom is pigmentation of the skin, which in some cases has led to the diagnosis of Addison's disease. A striking peculiarity of tuberculous peritonitis is the frequency with which either the condition simulates or is associated with *tumor*. These may be:

(*a*) *Omental*, due to puckering and rolling of this membrane until it forms an elongated firm mass, attached to the transverse colon and lying athwart the upper part of the abdomen. This cord-like structure is found also with cancerous peritonitis, but is much more common in tuberculosis. Gairdner has called special attention to this form of tumor, and in children has seen it undergo gradual resolution. A resonant percussion note may sometimes be elicited above the mass. Though usually situated in the umbilical region, the omental mass may form a prominent tumor in the right iliac region.

(*b*) *Sacculated exudation*, in which the effusion is limited and confined by adhesions between the coils, the parietal peritonæum, the mesentery, and the abdominal or pelvic organs. This encysted exudate is most common in the middle zone, and has frequently been mistaken for ovarian tumor. It may occupy the entire anterior portion of the peritonæum, or there may be a more limited saccular exudate on one side or the other. It may lie completely within the pelvis proper, associated with tuberculous disease of the Fallopian tubes.

(*c*) In rare cases the tumor formations may be due to great retraction or thickening of the *intestinal coils*. The small intestine is found shortened, the walls enormously thickened, and the entire coil may form a firm knot close against the spine, giving on examination the idea of a solid mass. Not the small intestine only, but the entire bowel from the duodenum to the rectum, has been found forming such a hard nodular tumor.

(*d*) *Mesenteric glands*, which occasionally form very large, tumor-like masses, more commonly found in children than in adults. This condition may be confined to the abdominal glands. Ascites may coexist. The condition must be distinguished from that in children, in which, with ascites or tympanites—sometimes both—there can be felt irregular nodular masses, due to large caseous formations between the intestinal coils. No doubt in a considerable number of cases of the so-called tabes mesenterica, particularly in those with enlargement and hardness of the abdomen—the condition which the French call *carreau*—there is involvement also of the peritonæum.

The *diagnosis* of these peritoneal tumors is sometimes very difficult. The omental tumor is a less frequent source of error than any other; but, as already mentioned, a similar condition may occur in cancer. The most important problem is the diagnosis of the saccular exudation from ovarian tumor. In fully one third of the recorded cases of laparotomy in tuberculous peritonitis, the diagnosis of cystic ovarian disease had been made. The most suggestive points for consideration are the history of the patient and the evidence of old tuberculous lesions. The physical condition is not of much moment, as in many instances the patients have been robust and well nourished. Irregular febrile attacks, gastro-intestinal disturbance, and pains are more common in tuberculous disease. Unless inflamed there is usually not much fever with ovarian cysts. The local signs are very deceptive, and in certain cases have conformed in every particular to those of cystic disease. The outlines in saccular exudation are rarely so well defined. The position and form may be variable, owing to alterations in the size of the coils of which in parts the walls are composed. Nodular cheesy masses may sometimes be felt at the periphery. Depression of the vaginal wall is mentioned as occurring in encysted peritonitis; but it is also found in ovarian tumor. Lastly, the condition of the Fallopian tubes, of the lungs and of the pleuræ, should be thoroughly examined. The association of salpingitis with an ill-defined anomalous mass in the abdomen should arouse suspicion, as should also involvement of the pleura, the apex of one lung, or a testis in the male.

VI. Tuberculosis of the Alimentary Canal.

(*a*) *Lips.*—Tuberculosis of the lip is very rare. It occurs occasionally in the form of an ulcer, either alone or more commonly in association with laryngeal or pulmonary disease. Two cases are reported and the literature analyzed in Verneuil's Études.* The ulcer is usually very sensitive and may be mistaken for a chancre or an epithelioma. The diagnosis may be made in cases of doubt by inoculation or the examination of a portion for tubercle bacilli.

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* Tome iii, Fas. I.

(*b*) *Tongue.*—The disease begins by an aggregation of small granular bodies on the edge or dorsum. Ulceration proceeds, leaving an irregular sore with a distinct but uneven margin, and a rough, often caseous base. The disease extends slowly and may form an ulcer of considerable size. I have known it to be mistaken for epithelioma and the tongue to be excised. It is rarely met with except when other organs are involved. The glands of the angle of the jaw are not enlarged and the sore does not yield to iodide of potassium, which are points of distinction between the tuberculous and the syphilitic ulcer. In doubtful cases the inoculation test should be made, or a portion excised for microscopical examination.

(*c*) Tubercles may develop on the hard or soft *palate.* In a recent case under the care of my colleague Halsted there was a rough, irregular patch on the roof of the mouth, grayish in spots, and fissured.

(*d*) Tuberculosis of the *tonsil* has been recorded in a few cases, either in the form of the miliary granules or as caseous foci. Ulceration may occur. In the acute cases the submaxillary glands may be enlarged.

(*e*) *Pharynx.*—In extensive laryngeal tuberculosis an eruption of miliary granules on the posterior wall of the pharynx is not very uncommon. In chronic phthisis an ulcerative pharyngitis, due to extension of the disease from the epiglottis and larynx, is one of the most distressing of complications, rendering deglutition acutely painful.

(*f*) A few instances occur in literature of tuberculosis of the *œsophagus.* The condition is a pathological curiosity, except in the slight extension from the larynx, which is not infrequent.

(*g*) *Stomach.*—Many cases are reported which are doubtful. Primary disease is unknown. Marfan * was able to collect only about a dozen authentic cases. Perforation of stomach occurred six times, thrice by a tuberculous gland. In Oppolzer's case an ulcer of the colon perforated the organ. In Musser's case there was a large tuberculous ulcer three by one and a half inches in extent.

(*h*) *Intestines.*—The tubercles may be (1) primary in the mucous membrane, or more commonly (2) secondary to disease of the lungs, or in rare cases the affection may (3) pass from the peritonæum.

(1) Primary intestinal tuberculosis occurs most frequently in children, in whom it may be associated with enlargement and caseation of the mesenteric glands, or with peritonitis. It may be difficult to say at the time of the autopsy whether the primary lesion has been intestinal or peritoneal. I have already referred to Woodhead's statistics showing the remarkable frequency of infection through the bowel. In adults primary intestinal tuberculosis is rare; but now and then cases occur in which the disease sets in with irregular diarrhœa, moderate fever, and colicky pains. In a few cases hæmorrhage has been the initial symptom. Regarded at first as a chronic catarrh, it is not until the emaciation becomes marked or

* Paris Thesis, 1887.

a case occurred in my clinic (No

In a recent case in my wards there were tuberculous ulcers of various extent

occurring in only one case in 1000 autopsies upon tuberculous adults at the Munich Pathological Institute.

Fatal haemorrhage has occurred several times in my practice
(see p.m. made 4.19.94)

In 566 cases of 1000 autopsies on tuberculous persons the intestines were affected secondarily & in only 3 where were the lungs not involved

the signs of disease appear in the lungs that the true nature is apparent. Still more deceptive are the cases in which the tuberculosis begins in the cæcum and there are symptoms of ~~typhlitis~~—tenderness in the right iliac fossa, constipation, or an irregular diarrhœa and fever. These signs may gradually disappear, to recur again in a few weeks, and still further complicate the diagnosis. Perforation may occur with the formation of a pericæcal abscess, or perforation into the peritonæum may take place, or in very rare instances there is partial healing with great thickening of the walls and narrowing of the lumen.

(2) Secondary involvement of the bowels is very common in chronic pulmonary tuberculosis. The lesions are chiefly in the ileum, cæcum, and colon. The affection begins in the solitary and agminated glands or on the surface of or within the mucosa. The caseation and necrosis lead to ulceration, which may be very extensive and involve the greater portion of the mucosa of the large and small bowels. In the ileum the Peyer's patches are chiefly involved and the ulcer may be ovoid, but in the jejunum and colon the ulcers are usually round or transverse to the long axis. The tuberculous ulcer has the following characters: (*a*) It is irregular, rarely ovoid or in the long axis, more frequently girdling the bowel. (*b*) The edges and base are infiltrated, often caseous. (*c*) The submucosa and muscularis are usually involved; and (*d*) on the serosa may be seen colonies of young tubercles or a well-marked tuberculous lymphangitis. Perforation and peritonitis are not uncommon events in the secondary ulceration. Stenosis of the bowel from cicatrization may occur; the strictures may be multiple.

Tuberculosis of the *rectum* has a special interest in connection with *fistula in ano*, which, according to Spillman's statistics, occurs in about 3·5 per cent of cases of pulmonary disease. In many instances the lesion has been shown to be tuberculous. It is very rarely primary, but if the tissue on removal contains bacilli and is infective the lungs are almost invariably found to be involved. It is a common opinion that the pulmonary symptoms may develop rapidly after the fistula is cut. This may have some basis if the operation consists in laying the tract open, and not in a free excision.

(3) Extension from the peritonæum may excite tuberculous disease in the bowels. The affection may be primary in the peritonæum or extend from the tubes in women or the mesenteric glands in children. The coils of intestines become matted together, caseous and suppurating foci develop between the folds, and perforation may take place between the coils at several different places.

VII. Tuberculosis of the Liver.

This organ is very constantly involved in (*a*) general tuberculosis. The miliary granulation may be very small and in acute cases scarcely perceptible. The liver is pale and often fatty.

(*b*) A remarkable condition of the organ is produced by the development of the tubercles in the finer bile-vessels. They may attain a considerable size and are almost always softened in the centre, resembling small abscesses. The contents are always bile-stained. The organ may be honeycombed with these tuberculous abscesses.

(*c*) Large, coarse caseous masses are occasionally found, sometimes in association with perihepatitis or tuberculous peritonitis. They may attain the size of an orange or larger.

(*d*) Tuberculous cirrhosis. With the eruption of miliary tubercles there may be slight increase in the connective tissue, which is overshadowed by the fatty change. In all the chronic forms of tubercle in this organ there may be fibrous overgrowth. Hanot, who has described several varieties, states that the condition may be primary. Practically it is very rare, except in connection with chronic tuberculous peritonitis and perihepatitis, when the organ may be much deformed by a sclerosis involving the portal canals.

In this last group there may be symptoms of ascites; as a rule, tuberculosis of the liver has a purely anatomical interest.

VIII. Tuberculosis of the Brain and Cord.

Tuberculosis of the *brain* occurs as (*a*) an acute miliary infection causing meningitis and acute hydrocephalus; (*b*) as a chronic meningo-encephalitis, usually localized, and containing small nodular tubercles; and (*c*) as the so-called solitary tubercle. Between the last two forms there are all gradations, and it is rare to see the meninges uninvolved. The acute variety has already been considered. I shall here consider the chronic form, which develops slowly and has the clinical characters of a tumor.

It is most common in the young. Of 148 cases collected by Pribram 118 were under fifteen years of age. Other organs are usually involved, particularly the lungs, the bronchial glands, or the bones. In rare instances no tubercles are found elsewhere. They occur most frequently in the cerebellum; next in the cerebrum and then in the pons. The growths are often multiple, in 100 out of 183 cases (Gowers). They range in size from a pea to a walnut; larger tumors occasionally occur, and sometimes an entire lobe of the cerebellum is affected. On section the tubercle presents a grayish-yellow, caseous appearance, usually firm and hard, and encircled by a translucent, softer tissue. The centre of the growth may be semi-diffluent. As in other localities the tubercle may calcify. The tu-

mors are as a rule attached to the meninges, often to the pia at the bottom of a sulcus so that they look imbedded in the brain-substance. About the longitudinal fissure there may be an aggregation of the growths, with compression of the sinus, and the formation of a thrombus. The tuberculous tumor not infrequently excites acute meningitis. In localized meningo-encephalitis the pia is thickened, tubercles are adherent to the under surface and grow about the arteries. It is often combined with cerebral softening from interference with the circulation. Several of the most characteristic instances which I have seen were on the meninges covering the insula. This form may develop in pulmonary tuberculosis, causing hemiplegia or aphasia which may persist for months.

The symptoms of tuberculous growths in the brain are those of tumor, and will be considered in the section on the brain.

In the *spinal cord* the same forms are found. The acute tuberculous meningitis has been considered and is almost always cerebro-spinal. The solitary tubercle of the cord is rare. Herter has reported three cases and collected twenty-four instances from the literature. It was secondary in all save one case. The symptoms are those of spinal tumor or meningitis.

IX. Tuberculosis of the Genito-urinary System.

(*a*) **Tuberculosis of the Kidneys** (*Phthisis renum*).—In general tuberculosis the kidneys frequently present scattered miliary tubercles. In pulmonary tuberculosis it is common to find a few nodules in the substance of the organ, or there may be pyelitis. Primary tuberculosis of the kidneys is not very rare. In a majority of the cases the process involves the pelvis and the ureter as well, sometimes the bladder and prostate. In only one of eight cases was the prostate involved. It may be difficult to say in advanced cases whether the disease has started in the bladder, prostate, or vesicles, and crept up the ureters, or whether it started in the kidneys and proceeded downward. In a majority of cases it is, I believe, the latter, and the infection is through the blood. One kidney alone may be involved, and the disease creeps down the ureter and may only extend a few millimetres on the vesical mucosa. In a recent instance a man with aortic insufficiency, who had no lesions in the lungs, presented a localized patch in the pelvis, involving a pyramid, while the ureter, five centimetres from the bladder and at its orifice, was thickened and tuberculous. The prostate showed an area of caseation. It is most common in the middle period of life, but it may occur at the extremes of age. It is more frequent in men than in women. In the earliest stage, which may be met with accidentally, the disease is seen to begin in the pyramids and calyces. Necrosis and caseation proceed rapidly, and the colonies of tubercles start throughout the pyramids and extend upon the mucous membrane of the pelvis. As a rule, from the outset, it is a tuberculous pyo-nephrosis. The disease may be confined to one kidney, or progress more extensively in

one than in the other. At autopsy both organs are usually found enlarged. One organ may be completely destroyed and converted into a series of cysts containing cheesy substance; a form of kidney which the older writers called scrofulous. In the putty-like contents of these cysts lime salts may be deposited. In other instances the walls of the pelvis are thickened and cheesy, the pyramids eroded, and caseous nodules are scattered through the organ, even to the capsule, which may be thickened and adherent. The other organ is usually less affected, and shows only pyelitis or a superficial necrosis of one or two pyramids. The ureters are usually thickened and the mucous membrane ulcerated and caseous. Involvement of the bladder, vesiculæ seminales, and testes is not uncommon in males.

The *symptoms* are those of pyelitis. The urine may be purulent for years, and there may be little or no distress. When the bladder becomes involved micturition is frequent, and many instances are mistaken for cystitis. The condition is for many years compatible with fair health. The curability is shown by the accidental discovery of the so-called scrofulous kidney, converted into cysts containing a putty-like substance. In cases in which the disease becomes advanced and both organs are affected, constitutional symptoms are more marked. There is irregular fever, with chills, and loss of weight and strength. General tuberculosis is common. In only one of my cases were the lungs uninvolved. In a case at the Montreal General Hospital a cyst perforated and caused fatal peritonitis.

Physical examination may detect special tenderness on one side, or the kidney may be palpable in front on deep pressure; but tuberculous pyelonephritis seldom causes a large tumor. Occasionally the pelvis becomes enormously distended; but this is rare in comparison with calculous pyelitis. The urine presents changes similar to those of ordinary calculous pyelitis — pus-cells, epithelium, and occasionally definite caseous masses. Albumen is, of course, present. Tubercle bacilli may be demonstrated by the ordinary methods. Tube-casts are not often seen.

To distinguish the condition from calculous pyelitis is often difficult. Hæmorrhage may be present in both, though not nearly so frequently in the tuberculous disease. Careful examination of the pus for tubercle bacilli gives most important information. The lungs or other organs may be tuberculous.

The incidence of renal in uro-genital tuberculosis may be gathered from Orth's Göttingen material, analyzed by Oppenheim. Of 60 cases there were 34 in which the kidneys were involved.

(*b*) **Tuberculosis of the Ureters and Bladder.**—This rarely occurs as a primary affection, but is nearly always secondary to involvement of other parts, particularly the pelvis of the kidney. In the case of uro-genital tuberculosis, above mentioned, in a patient who died of heart disease, the ureter, just where it enters the bladder, showed a fresh patch of tuberculosis.

Protracted cystitis, which has come on without apparent cause, is

In one case albuminuria preceded the pyuria for at least a year or more. (Stuckhow
Case of Ransom

Primary Bladder + tuberculosis, may simulate Calculus appearing first in the posterior wall

Per rectum the prostatic lobes are felt to be ~~each~~ occupied by hard nodules - up to the size of a bean. There is great irritability of the bladder + dysuria pain in catheterization

In preceding case condition is primary urethral tuberculosis accumulation stricture.

always suggestive of tuberculosis. The renal regions, the testes, and the prostate should be examined with care. It may follow a pyelo-nephritis or be associated with primary disease of the prostate or vesiculæ seminales.

(*c*) **Tuberculosis of the Prostate and Vesiculæ Seminales.**—The prostate is frequently involved in tuberculosis of the uro-genital tract. In Krzyincki's cases, of 15 males the prostate was involved in 14 and the vesiculæ seminales in 11. In Orth's cases the prostate was involved in 18 of the 37 cases in males. These parts are much more frequently involved than ordinary post-mortem statistics indicate.

(*d*) **Tuberculosis of the Testes.**—This somewhat common affection may be primary, or, more frequently, is secondary to tuberculous disease elsewhere. Many cases occur before the second year, and it is stated to have been met with in the fœtus. In infants it is serious and usually associated with tuberculous disease in other parts. In nine cases recently reported by Hutinel and Deschamps * in every one there was a general affection. In 20 cases reported by Jullien † 6 were under one year, and 6 between one and two years old. In five of the cases both testicles were affected. Koplik holds that most of the cases of this kind are congenital, in Baumgarten's sense. In the adult the tubercles begin within the substance of the gland, but in children the tunica albuginea is first affected. The tubercle does not always undergo caseation, but it may present a number of embryonic cells, not unlike a sarcoma.

Tubercle of the testes is most likely to be confounded with syphilis. In the latter the body of the organ is most often affected, there is less pain, and the outlines of the growth are more nodular and irregular. In obscure peritoneal disease the detection of tubercle in a testis has not infrequently led to a correct diagnosis. The association of the two conditions is not uncommon. The lesion in the testis may heal completely, or the disease may become generalized. General infection has followed operation.

(*e*) **Tuberculosis of the Fallopian Tubes, Ovaries, and Uterus.**—The special attention which has been paid to local affections of these parts by gynæcologists has taught us that primary tuberculosis of the tubes is not at all uncommon. Within a year my colleague, Kelly, has operated upon five or six cases. The disease may be primary and produce a most characteristic form of salpingitis, in which the tubes are enlarged, the walls thickened and infiltrated, and the contents cheesy. Adhesion takes place between the fimbriæ and the ovaries, or the uterus may be invaded. The condition is usually bilateral. It may occur in young children. Although, as a rule, very evident to the naked eye, there are specimens resembling ordinary salpingitis, which show on microscopical examination numerous miliary tubercles (Welch and Williams). Tuberculous salpingitis may

* Archives Générales de Médecine, 1891. † Ibid., 1890.

cause serious local disease with abscess formation, and it may be the starting-point of peritonitis.

Tuberculosis of the uterus is very rare. Only three examples have come under my observation, all in connection with pulmonary phthisis. It may be primary. The mucosa of the fundus is thickened and caseous, and tubercles may be seen in the muscular tissue. Occasionally the process extends to the vagina.

XI. Arteries.

Primary tuberculosis of the larger blood-vessels is unknown. The disease may, however, occur in a large artery and not result from external invasion. In a case of chronic phthisis from my ward Councilman found a fresh tuberculous growth in the aorta, which had no connection with cheesy masses outside the vessel.

In the lungs and other organs attacked by tuberculosis the arteries are involved in an acute infiltration which usually leads to thrombosis, or tubercles may develop in the walls and proceed to caseation and softening frequently with the result of hæmorrhage. By extension into vessels, particularly veins, the bacilli are widely distributed. In meningitis tuberculosis of the arteries plays an important *rôle*.

XII. The Prognosis in Tuberculosis.

Not all persons in whose bodies the bacilli gain a foothold present marked signs of tuberculosis. As will be stated in the next section, local disease is found in a considerable number of all cadavers. Infection does not necessarily mean the establishment of a progressive and fatal disease. In my autopsies, excluding cases dead of pulmonary phthisis, 7·5 per cent presented tuberculous lesions of the lungs—a low percentage in comparison with other records, as I carefully excluded the simple fibroid puckering at the apex and the solitary cheesy nodule, unless surrounded by colonies of tubercles.

In many cases a natural or spontaneous cure is effected, for the conditions favorable to the development of the disease are not present—in other words, the tissue-soil is unsuitable. Apart from this group, a majority of which probably do not show any sign of disease, there may be spontaneous arrest after the symptoms have become decided. Many years ago Flint called attention to the self-limitation and intrinsic tendency to recovery in well-marked pulmonary tuberculosis. Of his 670 cases, 44 recovered, and in 31 the disease was arrested, spontaneously in 23 of the first group and in 15 of the second. This natural tendency to cure is still more strikingly shown in lymphatic and bone tuberculosis.

The following may be considered favorable circumstances in the prognosis of pulmonary tuberculosis: A good family history, previous good health, a strong digestion, a suitable environment, and an insidious onset,

XX Tuberculosis of the Mammary Gland

Maudry (Bruns Beiträge viii) has collected about forty cases of which only 2 were in full detail. One was in a male. The disease is most common between the 30th & 60th years. The breast is frequently painless & the nipple retracted. The pustule & ulcer present a characteristic tuberculous aspect. There is also a cold tuberculous abscess of the breast. The axillary glands are affected in about two thirds of the cases. Tuberculosis of the breast runs a chronic course of months or years. The diagnosis can be made by the general character of the pustule & ulcers & by the presence of tubercle bacilli. The prognosis is not necessarily bad & total eradication of the disease possible.

XXI Tuberculosis of the Skin

without high fever, and without extensive pneumonic consolidation. Cases beginning with pleurisy seem to run a more protracted and more favorable course. Repeated attacks of hæmoptysis are unfavorable. When well established the course of tuberculosis in any organ is marked by intervals of weeks or months in which the fever lessens, the symptoms subside, and there is improvement in the general health.

In pulmonary cases the duration is extremely variable. Laennec placed the average duration at two years, and for the majority of cases this is perhaps a correct estimate. Pollock's large statistics of over 3,500 cases shows a mean duration of the disease of over two years and a half. Williams's analysis of 1,000 cases in private practice shows a much more protracted course, as the average duration was over seven years.

Under the subject of prognosis comes the question of the marriage of persons who have had tuberculosis, or in whose family the disease prevails. The following brief statements may be made with reference to it:

(*a*) Subjects with healed lymphatic or bone tuberculosis marry with personal impunity and may beget healthy children. It is undeniable, however, that in such families, scrofula, caries of the bone, arthritis, cerebral and pulmonary tuberculosis are more common. Which is it, "hérédité de graine ou hérédité de terrain," as the French have it, the seed or the soil, or both? We cannot yet say. The risks, however, are such as may properly be taken.

(*b*) The question of marriage of a person who has arrested or cured lung tuberculosis is more difficult to decide. If a male, the personal risk is not so great; and when the health and strength are good, the external environment favorable, and the family history not extremely bad, the experiment—for it is such—is often successful, and many healthy and happy families are begotten under these circumstances. In women the question is complicated with that of child-bearing, which increases the risks enormously. With a localized lesion, absence of hereditary taint, good physique, and favorable environment, marriage might be permitted. When tuberculosis has existed, however, in a girl whose family history is bad, whose chest expansion is slight, and whose physique is below the standard, the physician should, if possible, place his veto upon marriage.

(*c*) With existing disease, fever, bacilli, etc., marriage should be absolutely prohibited. Pregnancy and parturition hasten the process in almost every case. There is much truth, indeed, in the remark of Dubois: "If a woman threatened with phthisis marries, she may bear the first accouchement well; a second, with difficulty; a third, never."

XII. Prophylaxis in Tuberculosis.

(*a*) *General.*—The sputa of phthisical patients should be carefully collected and destroyed. Patients should be urged not to spit about carelessly, but always to use a spit-cup. Several forms of portable flasks have

been devised and are now on sale. The destruction of the sputa of consumptives should be a routine measure in both hospital and private practice. Thorough boiling or putting it into the fire is sufficient. It should be explained to the patient that the only risk, practically, is from this source. The chances of infection are greater in young children. The nursing and care of consumptives involve very slight risks indeed if proper precautions are taken. The patient should occupy a single bed.

A second important general prophylactic measure relates to the inspection of dairies and slaughter-houses. The possibility of the transmission of tuberculosis by infected milk has been fully demonstrated, and in the interest of public health the state should take measures to stamp out tuberculosis in cattle. Systematic veterinary inspection of dairies, particularly in the large cities, should be made, and full power granted to confiscate and kill suspected animals. The abattoirs should be under skilled veterinary control, and the carcasses of animals with advanced tuberculosis confiscated. There is, however, much less danger of infection through meat than through milk.

(*b*) *Individual.*—A mother with pulmonary tuberculosis should not suckle her child. An infant born of tuberculous parents, or of a family in which consumption prevails, should be brought up with the greatest care and guarded most particularly against catarrhal affections of all kinds. Special attention should be given to the throat and nose, and on the first indication of mouth-breathing, or any obstruction of the nasopharynx, a careful examination should be made for adenoid vegetations. The child should be clad in flannel and live in the open air as much as possible, avoiding close rooms. It is a good practice to sponge the throat and chest night and morning with cold water. Special attention should be paid to diet and to the mode of feeding. The meals should be at regular hours and the food plain and substantial. From the outset the child should be encouraged to drink freely of milk. Unfortunately, in these cases there seems to be an uncontrollable aversion to fats of all kinds. As the child grows older, systematically regulated exercise or a course of pulmonary gymnastics may be taken. In the choice of an occupation preference should be given to an out-of-door life. Families with a marked predisposition to tuberculosis should, if possible, reside in an equable climate. It would be best for a young man belonging to such a family to remove to Colorado or southern California, or to some other suitable climate, before trouble begins.

The trifling ailments of children should be carefully watched. In the convalescence from the fevers, which so frequently prove dangerous, the greatest caution should be exercised to prevent catching cold. Cod-liver oil, the syrup of iodide of iron, and arsenic may be given. As mentioned, care of the throat in these children is very important. When the tonsils are chronically enlarged they should be removed.

XIII. Treatment of Tuberculosis.

I. The Natural or Spontaneous Cure.—The spontaneous healing of local tuberculosis is an every-day affair. Many cases of adenitis and disease of the bone or of the joints terminate favorably without the aid of medicines. The healing of pulmonary tuberculosis is shown clinically by the recovery of patients in whose sputa elastic tissue and bacilli have been found; anatomically, by the presence of lesions in all stages of repair. In the granulation products and associated pneumonia a scar-tissue is formed, while the smaller caseous areas become impregnated with lime salts. To such conditions alone should the term healing be applied. When the fibroid change encapsulates but does not involve the entire tuberculous tissue, the tubercle may be termed involuted or quiescent, but is not destroyed. When cavities of any size have formed, healing, in the proper sense of the term, does not occur. I have yet to see a specimen which would indicate that a vomica had cicatrized. Cavities may be greatly reduced in size—indeed, an entire series of cavities may be so contracted by sclerosis of the tissue about them that an upper lobe, in which this process most frequently occurs, may be reduced to a third of its ordinary dimensions. Laennec understood thoroughly this natural process of cure in tuberculosis, and recognized the frequency with which old tuberculous lesions occurred in the lungs. He described *cicatrices complètes* and *cicatrices fistuleuses*, the latter being the shrunken cavities communicating with the bronchi; and suggested that, as tubercles growing in the glands, which are called scrofula, often heal, why should not the same take place in the lungs?

There is an old German axiom, "*Jedermann hat am Ende ein bischen Tuberculose*," a statement partly borne out by the statistics showing the proportion of cases in persons dying of all diseases in whom quiescent or tuberculous lesions are found in the lungs. We find at the apices the following conditions, which have been held to signify healed tuberculous processes: (1) Thickening of the pleura, usually at the posterior surface of the apex, with subadjacent induration for a distance of a few millimetres. This has, perhaps, no greater significance than the milky patch on the pericardium. (2) Puckered cicatrices at the apex, depressing the pleura, and on section showing a large pigmented, fibrous scar. The bronchioles in the neighborhood may be dilated, but there are neither tubercles nor cheesy masses. This may sometimes, but not always, indicate a healed tuberculous lesion. (3) Puckered cicatrices with cheesy or cretaceous nodules, and with scattered tubercles in the vicinity. (4) The *cicatrices fistuleuses* of Laennec, in which the fibroid puckering has reduced the size of one or more cavities which communicate directly with the bronchi.

In 1,000 autopsies, excluding the 216 cases dead of phthisis, there were 59 cases (7·5 per cent) which presented undoubted tuberculous lesions in

the lungs. I excluded the simple fibroid puckering and the solitary cheesy nodules, unless, in the latter case, there were colonies of tubercles in the vicinity. These 59 cases died of various diseases and at various ages. A majority of them were between forty and sixty. My experience tallies closely with the larger analysis made by Heitler of the Vienna post-mortem records, in which, of 16,562 cases in which the death was not directly caused by phthisis, there were 780 instances of obsolete tubercle—a percentage of 4·7. He excluded, as I have done, the simple fibroid induration. Various observations have been made of late in which the percentage ranges from twenty-seven (Bollinger) to thirty-nine (Massini). In 200 autopsies, in which this point was specially examined, Harris found 38·8 per cent in which there were relics of former active tuberculosis. The statement is made by Bouchard that, of the post-mortems at the Paris morgue—generally upon persons dying suddenly—the percentage found with some evidence of tuberculous lesion, active or obsolete, is as high as seventy-five. These figures show the extraordinary frequency of pulmonary infection and the encouraging fact that in so large a percentage the disease remains local and undergoes a process of arrest or healing.

II. **General Measures.**—There are three indications—first, to place the patient in surroundings most favorable for the maintenance of a maximum degree of nutrition; second, to take such measures as, in a local or general way, influence the tuberculous processes; third, to alleviate symptoms.

The question of environment is of first importance in the treatment of tuberculosis. It is illustrated in an interesting and practical way by an experiment of Trudeau, showing that inoculated rabbits, confined in a dark, damp place, rapidly succumb, while others, allowed to run wild, either recover or show slight lesions. It is the same in human tuberculosis. A patient confined to the house—particularly in the close, overheated, stuffy dwellings of the poor, or treated in a hospital ward—is in a position analogous to the rabbit confined to a hutch in the cellar; whereas a patient living in the fresh air and sunshine for the greater part of the day has chances comparable to those of the rabbit running wild.

In the majority of cases the treatment has to be carried out at home and often under adverse conditions. Still, much can be done if the patient is kept out of doors in the fresh air for the greater part of each day. In pulmonary tuberculosis *neither the cough, the fever, the night-sweats, nor the hæmoptysis contra-indicates this rule.* Only when the weather is blustering or rainy should the patient remain in the house. It is remarkable how quickly improvement in many instances follows this fresh-air treatment. In cities the patient can be wrapped up and placed on a sofa or in a reclining-chair on the balcony or even in the yard.

The climatic treatment of tuberculosis is simply a modification of this plan. The requirements of a suitable climate are a *pure atmosphere*, an *equable temperature* not subject to rapid variations, and a *maximum*

amount of sunshine. Given these three factors, and it makes little difference *where* a patient goes so long as he lives an outdoor life.

The *purity* of the atmosphere is the first consideration, and it is this requirement that is met so well in the mountains and forests. Altitude is a secondary consideration. The rarefaction of the air in high altitudes is of benefit in increasing the respiratory movements in pulmonary disease, but brings about in time a condition of dilatation of the air-vesicles and a permanent increase in the size of the chest which is a marked disadvantage when such persons attempt subsequently to reside at the sea-level.

The temperature of the air is also a minor consideration, so long as it is tolerably equable and not subject to rapid variations. The winter climates of the Adirondacks, of Colorado, or of Davos have the advantage of a steady cold combined with sunshine, just as the resorts of the Southern States and California, and of the south of France and Italy, have a tolerably uniform high temperature with the maximum amount of sunshine. The dryness of the air is certainly an important though not an essential factor. That it is not essential is seen in the good results obtained in the resorts at the sea-level, such as Florida, or even Torquay or Falmouth, on the south coast of England—one of the most humid atmospheres in the world.

Other considerations which should influence the choice of a locality are good accommodations and good food. Very much is said concerning the choice of locality in the different stages of pulmonary tuberculosis, but when the disease is limited to an apex, in a man of fairly good personal and family history, the chances are that he may fight a winning battle if he lives out of doors in any climate, whether high, dry, and cold or low, moist, and warm. With bilateral disease and cavity formation there is but little hope of permanent cure, and the mild or warm climates are preferable.

Whether a patient should go from home or not is a grave question which the physician is called upon to decide. It is undoubtedly, in many instances, a positive hardship to send away a patient with tolerably advanced tuberculosis. With well-marked cavities, hectic fever, night-sweats, and emaciation he is better at home, and the physician should not be too much influenced by the importunities of the patient or his friends. Advanced cases and persons with feeble hearts should never be sent to high altitudes. Of American resorts I prefer the Adirondacks for early cases. The patient should go in October, so as to become gradually accustomed to the cold. It is accessible, the winter climate is admirable, and the camp-life delightful. As the reports of Saranac Sanitarium show, recent tuberculosis does remarkably well. Personally I have seen better results from the Adirondacks than from any other place. Colorado and southern California have this advantage for early cases—they are progressive, prosperous countries in which a man may find means of livelihood and live in comfort.*

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* On the question of climate, Yeo's work may be consulted with advantage.

Under this section reference may be made to the question of the treatment of tuberculosis in sanitaria. The larger cities should build special institutions within easy access by railway, with pleasant surroundings, in which early cases of pulmonary tuberculosis among the poor could be systematically treated. Advanced cases should not be admitted, but should be cared for in separate wards of the city hospitals. Sanitaria for the care of recent pulmonary tuberculosis among the well-to-do classes are also urgently needed. The results obtained at Falkenstein near Frankfurt a. M. (which certainly has nothing special, as far as climate is concerned) and at the Saranac Sanitarium illustrate how much can be done by method and care.

III. **Measures which, by their Local or General Action, influence the Tuberculous Process.**—Under this heading we may consider the specific, the dietetic, and the general medicinal treatment of tuberculosis.

(*a*) *The Specific Treatment.*—A glycerin extract of the cultures of tubercle bacilli was found by Koch to have a specific action upon tuberculous tissue. The influence of this tuberculin, as it is called, is best seen in lupus, upon which it exercises an extraordinary effect, unique in the history of the action of remedies. An injection of one milligramme is followed, in a few hours, by intense constitutional and local reaction. The affected tissues swell enormously, and the adjacent parts are deeply congested. Crusts form upon the surface, the swelling and inflammation gradually subside, and after several injections the lupus masses gradually disappear and are replaced by a white cicatricial tissue. Even in advanced cases of long duration the action is, in a majority of cases, prompt and beneficial. There is a great difficulty, however, in getting rid of the final remnants of the lupus tissue, and a combination of scraping with the tuberculin will probably always be needed.

In internal tuberculosis the remedy, in very early cases, may, as shown by Koch's reports, prove actually curative; unfortunately, it was employed in all classes of cases. In pulmonary tuberculosis it is a remedy to be used with the greatest caution. Of twenty-three cases in which we have used it at the Johns Hopkins Hospital, only three were benefited; in the others the action was either negative or actually detrimental. It should not be employed in cases with fever or with much consolidation. In many cases it seems to aggravate the general and local symptoms.

We are at present in the reaction wave, after being buoyed up by hopes that at last a remedy had been obtained which was positively curative in all forms of tuberculous lesions. It will probably be several years before we can speak with decision upon the true position of this remedy. Meanwhile our knowledge warrants us in urging extreme caution in its use. The recent reports of Schede indicate that the remedy has a very positive value in tuberculous arthritis when combined with other measures.

(*b*) *Dietetic Treatment.*—The outlook in tuberculosis depends much

upon the digestion. It is rare to see recovery in a case in which there is persistent gastric trouble, and the physician should ever bear in mind the fact that in this disease the *primæ viæ* control the position. The early nausea and loss of appetite in many cases of phthisis are serious obstacles. Many patients loathe food of all kinds. A change of air, or a sea voyage will promptly restore the appetite. When this is impossible, and if, as is almost always the case, fever is present, the patient should be placed at rest, kept in the open air nearly all day, and fed at stated intervals with small quantities either of milk, buttermilk, or koumyss, alternating if necessary with meat juice and egg albumen. Some cases which are disturbed by eggs and milk do well on koumyss. It may be necessary to resort to Débove's method of over-alimentation or forced feeding. The stomach is first washed out with cold water, and then, through the tube, a mixture is given containing a litre of milk, an egg, and one hundred grammes of very finely powdered meat. This is given three times a day. Sometimes the patients will take this mixture without the unpleasant necessity of the stomach-tube, in which case a smaller amount may be given. I can speak of the advantage of this plan in cases in which the gastric symptoms have been obstinate and distressing, and the general expression of opinion is, in such instances, very favorable to this plan of treatment.

In many cases the digestion is not at all disturbed and the patient can take an ordinary diet. It is remarkable how rapidly the appetite and digestion improve on the fresh-air treatment, even in cases which have to remain in the city. Care should be taken that the medicines do not disturb the stomach. Not infrequently the sweet syrups used in the cough mixtures, cod-liver oil, creasote, and the hypophosphites produce irritation, and by interfering with digestion do more harm than good. On the other hand, the bitter tonics, with acids, and the various malt preparations are often in these cases most satisfactory. The indications for alcohol in tuberculosis are enfeebled digestion with fever, a weak heart, and rapid pulse. A routine administration is not advisable, and there is no evidence that its persistent use promotes fibroid processes in the tuberculous areas. In the advanced stages, particularly when the temperature is low between eight and ten in the morning, whisky and milk, or whisky, egg, and milk may be given with great advantage. The red wines are also beneficial in moderate quantities.

(*c*) *General Medical Treatment.*—No medicinal agents have any special or peculiar action upon tuberculous processes. The influence which they exert is upon the general nutrition, increasing the physiological resistance and rendering the tissues less susceptible to invasion. The following are the most important remedies which seem to act in this manner :

Creasote, which may be administered in capsules, in increasing doses, beginning with one minim three times a day and, if well borne, increasing the dose to eight or ten minims. It may also be given in solution

with tincture of cardamom and alcohol. It is an old remedy, strongly recommended by Addison, and the reports of Jaccoud, Fraentzel, and many others show that it has a positive value in the disease. Guaiacol may be given as a substitute, either internally or hypodermically. In 101 cases in which it was used at my clinic, by Meredith Reese, the chief action was on the cough and expectoration, which were much lessened, but the remedy had no essential influence on the progress of the disease.

Cod-liver Oil.—In glandular and bone tuberculosis, this remedy is undoubtedly beneficial in improving the nutrition. In pulmonary tuberculosis its action is less certain, and it is scarcely worthy of the unbounded confidence which it enjoyed for so many years. It should be given in small doses, not more than a teaspoonful three times a day after meals. It seems to act better in children than in adults. When it is not well borne, a dessertspoonful of rich cream three times a day is an excellent substitute. The clotted or Devonshire cream is preferable.

The Hypophosphites.—These in various forms are useful tonics, but it is doubtful if they have any other action. They certainly exercise no specific influence upon tubercle. They may be given in the form of the syrup of the hypophosphites of calcium, sodium, and potassium of the U. S. P.

Arsenic.—There is no general tonic more satisfactory in cases of tuberculosis of all kinds than Fowler's solution. It may be given in five-minim doses three times a day and gradually increased; stopping its use whenever unpleasant symptoms arise, and in any case intermitting it every third or fourth week.

One or two special methods of dealing with pulmonary tuberculosis may here be mentioned. The local treatment, by direct injection into the lungs, has been practised since its strong advocacy by Pepper. It has, however, not gained the general support of the profession, and is occasionally followed by serious results. As a rule, it may be practised with impunity, and the injections may be made with a long hypodermic needle into any portion of the lung which is diseased. Iodine, carbolic acid, creasote (three per cent solution in almond oil), and iodoform have been used for the purpose. The remarkable results which surgeons have recently obtained in the treatment of joint tuberculosis by injections of iodoform point to this as a remedy which will probably prove of service when injected directly into the lungs.

Treatment by compressed air is in many cases beneficial, and under its use the appetite improves, there is gain in weight, and reduction of the fever. The air may be saturated with creasote.

IV. **Treatment of Special Symptoms in Pulmonary Tuberculosis.**—(*a*) *The Fever.*—There is no more difficult problem in practical therapeutics than the treatment of the pyrexia of tuberculosis. The patient should be at rest, and when practicable wheeled into the fresh air for as long a time as possible during the day. Fever does not contra-indicate an out-of-door

For the troublesome dysphagia a strong solution of Cocaine (gr x) with boric acid (gr x) in glycerine & water (℥i) should be used locally

life, but it is well for patients with a temperature above 101° or 102° to be at rest. For the continuous pyrexia or the remittent type of the early stages, quinine, small doses of digitalis, and the salicylates may be tried; but they are uncertain and rarely reliable. Under no circumstances is that priceless remedy, quinine, so much abused as in the fever of tuberculosis. In large doses it has a moderate antipyretic action, but it is just in these efficient doses that it is so apt to disturb the stomach.

Antipyrin and antifebrin may be used cautiously; but it is better, when the fever rises above 103°, to rely upon cold sponging or the tepid bath, gradually cooled. When softening has taken place and the fever assumes the characteristic septic type, the problem becomes still more difficult. As shown by Chart XIII (which is not by any means an exceptional one), the pyrexia, at this stage, lasts only for twelve or fifteen hours. As a rule it is not more than from eight to ten hours in which the fever is high enough to demand antipyretic treatment. Sometimes antifebrin, given in two-grain doses every hour for three or four hours before the rise in temperature takes place, either prevents entirely or limits the paroxysm. If the temperature begins to rise between two and three in the afternoon, the antifebrin may be given at eleven, twelve, one, and, if necessary, at two. It answers better in this way than given in the single doses. Careful sponging of the extremities for from half an hour to an hour during the height of the fever is useful. Quinine is of little benefit in this type of fever; the salicylates still less.

(*b*) *Sweating.*—The atropine, in doses of gr. $\frac{1}{120}$–$\frac{1}{60}$, and the aromatic sulphuric acid in large doses are the best remedies. When there are cough and nocturnal restlessness, an eighth of a grain of morphia may be given with the atropine. Muscarin (♏ v of a one per cent solution), tincture of nux vomica (♏ xxx), picrotoxin (gr. $\frac{1}{60}$) may be tried. The patient should use light flannel night-dresses, as the cotton night-shirts, when soaked with perspiration, have a very unpleasant cold, clammy feeling.

(*c*) The *cough* is a troublesome, though necessary, feature in pulmonary tuberculosis. Unless very worrying and disturbing sleep at night, or so severe as to produce vomiting, it is not well to attempt to restrict it. When irritative and bronchial in character, inhalations are useful, particularly the tincture of benzoin or preparations of tar, creasote, or turpentine. The throat should be carefully examined, as some of the most irritable and distressing forms of cough in phthisis result from laryngeal erosions. The distressing nocturnal cough, which begins just as the patient gets into bed and is preparing to fall asleep, requires, as a rule, preparations of opium. Codeia, in quarter or half grain doses, or the syrupus codeiæ (℥ j) may be given. An excellent combination for the nocturnal cough of phthisis is morphia (gr. $\frac{1}{8}$–$\frac{1}{6}$), dilute hydrocyanic acid (♏ ij–iij), and syrup of wild cherry (℥ j). The spirits of chloroform, B. P., or the mistura chloroformi, U. S. P., or Hoffman's anodyne, given

in whisky before going to sleep, are efficacious. Mild counter-irritation, or the application of a hot poultice, will sometimes promptly relieve the cough. In the later stages of the disease, when cavities have formed, the accumulated secretion must be expectorated and the paroxysms of coughing are now most exhausting. The sedatives, such as morphia and hydrocyanic acid, should be given cautiously. The aromatic spirits of ammonia in full doses help to allay the paroxysm. When the expectoration is profuse, creasote internally, or inhalations of turpentine and iodine, are useful.

(*d*) For the *diarrhœa* large doses of bismuth, combined with Dover powder, and small starch enemata, with or without opium, may be given. The acetate of lead and opium pill often acts promptly, and the acid diarrhœa mixture, dilute acetic acid (♏ x–xv), morphia (gr. $\frac{1}{8}$), and acetate of lead (gr. j–ij), may be tried.

(*e*) The treatment of the hæmoptysis will be considered in the section on hæmorrhage from the lungs. Dyspnœa is rarely a prominent symptom except in the advanced stages, when it may be very troublesome and distressing. Ammonia and morphia, cautiously administered, may be used.

If the pleuritic pains are severe, the side may be strapped or painted with tincture of iodine. The dyspeptic symptoms require careful treatment, as the outlook in individual cases depends much upon the condition of the stomach. Small doses of calomel and soda often allay the distressing nausea of the early stage.

XXVII. LEPROSY.

Definition.—A chronic infectious disease caused by the *bacillus leprœ*, characterized by the presence of tubercular nodules in the skin and mucous membranes (tubercular leprosy) or by changes in the nerves (anæsthetic leprosy). At first these forms may be separate, but ultimately both are combined, and in the characteristic tubercular form there are disturbances of sensation.

Etiology.—The disease is very widely spread, and within the past few years renewed attention has been directed to it, owing to a belief that it is greatly on the increase. It is one of the oldest of known diseases. At present it prevails widely, particularly in hot countries. In India it is estimated that there are over 250,000 lepers. In Europe, where it prevailed in the middle ages, it has become almost unknown except in Norway and in the Orient. On this continent leprosy exists in the Gulf States and extensively in Mexico. At Key West Berger states that there are one hundred cases, and Blanc found forty lepers in New Orleans. A few isolated cases arrive from time to time in the cities of the Atlantic coast. In the Northwestern States a few cases exist among the Norwegian and Icelandic settlers. On the Pacific coast cases are seen not infrequently among the Chinese. An endemic focus is at Tracadie,

New Brunswick. A few cases are also met with in Cape Breton, N. S. At Tracadie, which is on a bay of the Gulf of St. Lawrence, the disease is limited to two or three counties which are settled by French Canadians. The disease was imported from Normandy about the end of the last century. The cases are confined in a lazaretto, to which they are sent so soon as the disease is manifest. I made a visit to the settlement two years ago with the medical officer, A. A. Smith, of Chatham, at which time there were only eighteen patients in the hospital. It is interesting to note that the disease has gradually diminished by segregation; formerly there were over forty under surveillance.

In the Sandwich Islands leprosy has developed to an enormous extent. Morrow states that in 1889 there were 1,100 lepers in the settlement at Molokai.

In the West Indies the disease has been long endemic, and Beavan Rake, of Trinidad, has contributed some of the most interesting of recent clinical and pathological studies.

The disease attacks all classes and persons of all ages. It is probably communicated by contagion. Inoculation was successfully performed by Arning in a Hawaiian convict. Graham, who some years ago carefully investigated the Tracadie settlement, came to the conclusion that the disease was there probably transmitted by contagion; and A. A. Smith, the present medical officer, tells me that he knows of no facts which are opposed to that view. It is, however, only contagious in the same sense as syphilis, and just as accidental contamination with this virus is extremely rare so it is with leprosy. The closest possible contact may take place for years, as between parent and child, without transmission, and not one of the Sisters of Charity who have for more than forty years so faithfully nursed the lepers at Tracadie has contracted the disease. It is difficult to explain the rapid spread of the disease in the Sandwich Islands on any other view than contagion, and yet it is strange that there is no evidence of a primary lesion or external sore comparable to that of syphilis. Morrow states that "in the immense majority of cases the disease is propagated by sexual congress."

The disappearance of the disease in the middle ages no doubt resulted directly from the isolation enforced at that time. The disease has possibly in some instances been transmitted by vaccination. Hereditary transmission cannot be excluded, and there is no good reason why the disease should not be communicated, as is syphilis, from parent to child.

Jonathan Hutchinson believes that the disease is always associated with some special kind of food, particularly fish. Though he does not deny the specific nature of the disease or the possibility of contagion, he would make apparently the fish diet the *tertium quid* which renders the patient susceptible, or, if I gather aright from his recent communication, with which the poison may be taken. The facts which are manifest at the Tracadie settlement are very much opposed to this view. If a fish diet

could alone in any way induce the disease, by this time leprosy would be wide-spread in the counties along the Gulf of St. Lawrence, as fish is the main article of diet winter and summer. There is not the slightest difference in race, the mode of life, or in the surroundings of the inhabitants in the regions adjacent to Caraquet and Tracadie, and yet leprosy has been for nearly a century limited to two or three counties.

The Bacillus Lepræ.—Hansen, of Bergen, first discovered this organism, which has many points of resemblance to the *bacillus tuberculosis*, but can be differentiated from it. It occurs in extraordinary numbers in the tuberculous tissue. It has been cultivated successfully (Babes), but inoculation experiments on animals have been negative.

Morbid Anatomy.—The leprosy tubercles consist of granulomatous tissue made up of cells of various sizes in a connective-tissue matrix. The bacilli in extraordinary numbers lie partly between and partly in the cells. The growth gradually involves the skin, producing tuberous outgrowths with intervening areas of ulceration or cicatrization, which in the face may gradually produce the so-called *facies leontina*. The mucous membranes, particularly the conjunctiva, the cornea, the larynx, may be gradually involved. In many cases deep ulcers form which result in extensive loss of substance or loss of fingers or toes, the so-called *lepra mutilans*. In anæsthetic leprosy there is a peripheral neuritis due to the development of the bacilli in the nerve-fibres. Indeed, this involvement of the nerves plays a primary part in the etiology of many of the important features, particularly the trophic changes in the skin and the disturbances of sensation.

Clinical Forms.—(*a*) **Tubercular Leprosy.**—Prior to the appearance of the nodules there are areas of cutaneous erythema which may be sharply defined and often hyperæsthetic. This is sometimes known as *macular* leprosy. The affected spots in time become pigmented. In some instances this superficial change continues without the development of nodules, the areas become anæsthetic, the pigment gradually disappears, and the skin gets perfectly white—the *lepra alba*. Among the patients at Tracadie it was particularly interesting to see three or four in this early stage presenting on the face and forearms a patchy erythema with slight swelling of the skin. The diagnosis of the condition is perfectly clear, though it may be a long time before any other than sensory changes develop. The eyelashes and eyebrows and the hairs on the face fall out. The mucous membranes finally become involved, particularly the mouth, throat, and larynx; the voice becomes harsh and finally aphonic. Death results not infrequently from the laryngeal complications and aspiration pneumonia. The conjunctivæ are frequently attacked, and the sight is lost by a leprous keratitis.

(*b*) **Anæsthetic Leprosy.**—This remarkable form has, in characteristic cases, no external resemblance whatever to the other variety. It usually begins with pains in the limbs and areas of hyperæsthesia or of numbness.

Very early there may be trophic changes, seen in the formation of small bullæ (Hillis). Maculæ appear upon the trunk and extremities, and after persisting for a variable time gradually disappear, leaving areas of anæsthesia, but the loss of sensation may come on independently of the outbreak of maculæ. The nerve-trunks, where superficial, may be felt to be large and nodular. The trophic disturbances are usually marked. Pemphigus-like bullæ develop in the affected areas, which break and leave ulcers which may be very destructive. The fingers and toes are liable to contractures and to necrosis, so that in chronic cases the phalanges are lost. The course of anæsthetic leprosy is extraordinarily chronic and may persist for years without leading to much deformity. One of the most prominent clergymen on this continent has had anæsthetic leprosy for more than thirty years, which until recently has not seriously interfered with his usefulness, and not in the slightest with his career.

Diagnosis.—Even in the early stage the dusky erythematous maculæ with hyperæsthesia or areas of anæsthesia are very characteristic. In an advanced grade neither the tubercular nor anæsthetic forms could possibly be mistaken for any other affection.

Treatment.—There are no specific remedies in the disease, and general tonics combined with local treatment meet the only available indications. The gurjun and chaulmoogra oils have been recommended, the former in doses of from five to ten minims, the latter in two-drachm doses. The cases should be isolated, although the risk of catching the disease by direct contagion is extremely slight.

XXVIII. GLANDERS (*Farcy*).

Definition.—An infectious disease of the horse, communicated occasionally to man. In the horse it is characterized by the formation of nodules, chiefly in the nares (glanders) and beneath the skin (farcy).

Etiology.—The disease belongs to the infective granulomata. The local manifestations in the nostrils and the skin of the horse are due to one and the same cause. The specific germ was discovered by Loeffler and Schütz. It is a short, non-motile bacillus, not unlike that of tubercle. It grows readily on the ordinary culture media. For the full recognition of glanders in man we are indebted to the labors of Rayer, whose monograph remains one of the best descriptions ever given of the disease. Man becomes infected by contact with diseased animals, and usually by inoculation on an abraded surface of the skin. The contagion may also be received on the mucous membrane. In one of the Montreal cases a gentleman was probably infected by the material expelled from the nostrils of his horse, which was not suspected to have the disease.

Morbid Anatomy.—As in the horse, the disease may be localized in the nose (glanders), or beneath the skin (farcy). The essential lesion

is the granulomatous tumor, characterized by the presence of numerous lymphoid and epithelioid cells, among and in which are seen the glanders bacilli. These nodular masses tend to break down rapidly, and on the mucous membrane form ulcers, while beneath the skin they form abscesses. The glanders nodules may also occur in the internal organs.

Symptoms.—An acute and a chronic form of glanders may be recognized in man, and an acute and a chronic form of farcy.

Acute Glanders.—The period of incubation is rarely more than three or four days. There are signs of general febrile disturbance. At the place of infection there are swelling, redness, and lymphangitis. Within two or three days there is involvement of the mucous membrane of the nose, the nodules break down rapidly to ulcers, and there is a mucopurulent discharge. An eruption of papules, which rapidly become pustules, breaks out over the face and about the joints. It has been mistaken for variola. This was carefully studied by Rayer and is figured in his monograph. In a Montreal case this copious eruption led the attending physician to suspect small-pox, and the patient was isolated. There is great swelling of the nose. The ulceration may go on to necrosis, in which case the discharge is very offensive. The lymph-glands of the neck are usually much enlarged. Subacute pneumonia is very apt to develop. This form runs its course in about eight or ten days, and is invariably fatal.

Chronic glanders is rare and difficult to diagnose, as it is usually mistaken for a chronic coryza. There are ulcers in the nose, and often laryngeal symptoms. It may last for months, or even longer, and recovery sometimes takes place. The diagnosis may be extremely difficult. In such cases cultures should be made and portions of the pure culture inoculated in the guinea-pig. The animal dies within thirty hours, and the testicles are found to be enormously swollen and already in the condition of abscess.

Acute farcy in man results usually from the inoculation of the virus into the skin. There is an intense local reaction with a phlegmonous inflammation. The lymphatics are early affected, and along their course there are nodular subcutaneous enlargements, the so-called farcy buds, which may rapidly go on to suppuration. There are pains and swelling in the joints and abscesses may form in the muscles. The symptoms are those of an acute infection, almost like an acute septicæmia. The nose is not involved and the superficial skin eruption is not common.

The disease is fatal in a large proportion of the cases, usually in from twelve to fifteen days.

Chronic farcy is characterized by the presence of localized tumors, usually in the extremities. These tumors break down into abscesses, and sometimes form deep ulcers, without much inflammatory reaction and without special involvement of the lymphatics. The disease may last for months or even years. Death may result from pyæmia, or occasionally

infective disorder

It is not uncommon in Germany and Russia
To the End of 1892 ~~was~~ about 450 cases had been
described. Leith (Edinburgh Hospital Reports. Vol ii)

Is / probably / Group of bacteria

~~These are three elements in the fuchsin, filaments cocci~~ & or opaque
dots

The relation of these three elements is still in dispute.

It is nearly three times as common in men as in women

There is no evidence that the flesh or milk of diseased animals
~~has ever caused~~ To direct inoculation with

acute glanders develops. The celebrated French veterinarian, Bouley, had it and recovered.

The disease is transmissible also from man to man. Washer-women have been infected from the clothes of a patient. In the diagnosis of this affection the occupation is very important. Nowadays, in cases of doubt, the inoculation should be made in animals, as in this way the disease can be readily determined.

Treatment.—If seen early the wound should be either cut out or thoroughly destroyed by caustics, and an antiseptic dressing applied. The farcy buds should be early opened. In the acute cases there is very little hope. In the chronic cases recovery is possible, though often tedious.

XXIX. ACTINOMYCOSIS.

Definition.—A chronic inflammatory affection produced by the actinomyces or ray-fungus.

Etiology.—The disease is wide-spread among cattle, and occurs also in the pig. It was first described by Bollinger in the ox, in which it forms the affection known in this country as "big-jaw." Examples of the disease were common in the cattle killed at the abattoir in Montreal. In man the disease was first described by James Israel, and subsequently Ponfick insisted upon the identity of the disease in man and cattle.

In this country and in England the disease is rare, and only a few cases have been described. Although familiar with the affection in cattle since 1878, and constantly on the lookout for the disease, no instance has fallen under my personal observation.

The *parasite* is a fungus belonging to the species *Cladothrix*. In both man and cattle it can be seen in the pus from the affected region as small yellowish granules from one half to two millimetres in diameter. Microscopically these bodies are seen to be made up of threads which radiate from a centre and present bulbous, club-like terminations. Böstrom has recently published an elaborate research on their structure and development.

The parasite has been successfully cultivated and the disease has been inoculated, both with the natural and artificially grown fungus.

The Mode of Infection.—The fungus has not been detected outside the body. It seems highly probable that it is taken in with the food. The site of infection in a majority of cases in man and animals is in the mouth or neighboring passages. In the cow, possibly also in man, ears of barley or rye have been carriers of the fungus.

Morbid Anatomy.—In the earliest stages of its growth the parasite gives rise to a small granulation tumor, not unlike that produced by the *bacillus tuberculosis*, which contains, in addition to small round cells, epithelioid elements and giant cells. After it reaches a certain size there

is great proliferation of the surrounding connective tissue, and the growth may, particularly in the jaw, look like, and was long mistaken for, osteosarcoma. Finally suppuration occurs, which, according to Israel, may be produced directly by the fungus itself.

Clinical Forms.—(*a*) **Alimentary Canal.**—Israel is said to have found the fungus in the cavities of carious teeth. The jaw has been involved in a number of cases in man. The patient comes under observation with swelling of one side of the face, or with a chronic enlargement of the jaw which may simulate sarcoma. In the case described by Bodamer at the German Hospital, Philadelphia, the swelling involved the right side of the face, the temporal region, and the neck; there were numerous sinuses, and the case had the appearance of chronic necrosis of the bones.

The tongue has been involved in several cases, forming small growths, which in one instance were primary, in the others secondary to disease of the jaw. In the intestines the disease may occur either as a primary or secondary affection. At the Charité in Berlin in 1884 I saw with Oscar Israel a remarkable instance in which there were actinomycotic ulcers in the small intestines. Cases have been reported of pericæcal abscess due to the fungus. An instance of primary actinomycosis of the large intestine with metastases has also been described. The liver may be affected primarily, as in the case reported by Sharkey and Acland.

(*b*) **Pulmonary Actinomycosis.**—In September, 1878, James Israel described a remarkable mycotic disease of the lungs, which subsequent observation showed to be the affection described the year before by Bollinger in cattle. Since that date thirty-four instances have been reported in which the lungs were affected. Hodenpyl has analyzed these and reports two cases from the Roosevelt Hospital.

It is a chronic infectious disorder of the lungs, characterized by cough, fever, wasting, and a muco-purulent, sometimes fœtid, expectoration. The lesions are unilateral in a majority of the cases. Hodenpyl classifies them in three groups: (1) Lesions of chronic bronchitis; in one case the diagnosis was made by the presence of the actinomyces in the sputum. (2) Miliary actinomycosis, closely resembling miliary tubercle, but the nodules are seen to be made up of groups of fungi, surrounded by granulation tissue. This form of pulmonary actinomycosis is not infrequent in oxen with advanced disease of the jaw or adjacent structures. (3) The cases in which there is more extensive destructive disease of the lungs, bronchopneumonia, interstitial changes, and abscesses, the latter forming cavities large enough to be diagnosed during life. Actinomycotic lesions of other organs are often present in connection with the pulmonary disease: erosion of the vertebræ, necrosis of the ribs and sternum, subcutaneous abscesses, and occasionally metastases in all parts of the body.

Symptoms.—The fever is of an irregular type and depends largely on the existence of suppuration. The cough is an important symptom, and

Ransom has found the actinomyces in the stools
(Med. Times 1884)

The actinomycotic abscesses present a reticular
or honeycomb-like arrangement. (Leith)

Thomassen has recommended Iodide of Potassium and
in doses of from 40 to 60 grains daily has proved curative
in a number of recent cases.

the diagnosis in eighteen of the cases was made during life by the discovery of the actinomyces. Death results usually with septic symptoms. Occasionally there is a condition simulating typhoid fever. The average duration of the disease was ten months. Of the thirty-four cases all died except two. Clinically the disease closely resembles certain forms of pulmonary tuberculosis and of fœtid bronchitis. It is not to be forgotten in the examination of the sputum that, as Bizzozero mentions, certain degenerated epithelial cells may resemble the fungus. The radiating leptothrix threads about the epithelium of the mouth sometimes present a striking resemblance.

(*c*) **Cutaneous Actinomycosis.**—In several instances in connection with chronic ulcerative disease of the skin the ray-fungus has been found. It is a very chronic affection, associated with the development of tumors which suppurate and leave open sores which may remain for years. It resembles tuberculosis of the skin.

(*d*) **Cerebral Actinomycosis.**—Bollinger has reported an instance of primary disease of the brain. The symptoms were those of tumor. A second remarkable case has been reported by Gamgee and Delépine. The patient was admitted to St. George's Hospital with left-sided pleural effusion. At the post-mortem three pints of purulent fluid were found in the left pleura; there was an actinomycotic abscess of the liver, and in the brain there were abscesses in the frontal, parietal, and temporo-sphenoidal lobes which contained the mycelium, but no clubs. A third case, reported by O. B. Keller, had *empyema necessitatis*, which was opened and actinomyces were found in the pus. Subsequently she had Jacksonian epilepsy, for which she was trephined twice and abscesses opened, which contained actinomyces grains. Death occurred after the second operation.

Diagnosis.—The disease is often mistaken for and is in reality a chronic pyæmia. The only test is the presence of the actinomyces in the pus. Metastases may occur as in pyæmia and in tumors. The tendency, however, is rather to produce a local purulent affection which erodes the bones and is very destructive. In cattle the disease may cause metastases without any suppuration; thus in a Montreal case the jaw and tongue were the seat of the most extensive disease with very slight suppuration, while the lungs presented numbers of secondary growths containing the fungus.

Treatment.—This is largely surgical and is practically that of pyæmia. Incision of the abscess, removal of the dead bone, and thorough irrigation are appropriate measures.

XXX. INFECTIOUS DISEASES OF DOUBTFUL NATURE.

(1) FEBRICULA—EPHEMERAL FEVER.

Definition.—Fever of slight duration, probably depending upon a variety of causes.

A febrile paroxysm lasting for twenty-four hours and disappearing completely is spoken of as ephemeral fever. If it persists for three, four, or more days without local affection it is referred to as febricula.

The cases may be divided into several groups:

(*a*) Those which represent mild or abortive types of the infectious diseases. It is not very infrequent, during an epidemic of typhoid, scarlet fever, or measles, to see cases with some of the prodromal symptoms and slight fever which persist for two or three days without any distinctive features. I have already spoken of these in connection with the abortive type of typhoid fever. Possibly, as Kahler suggests, some of the cases of transient fever are due to the rheumatic poison.

(*b*) In a larger and perhaps more important group of cases the symptoms develop with dyspepsia. In children indigestion and gastro-intestinal catarrh are often accompanied by fever. Possibly some instances of longer duration may be due to the absorption of certain toxic substances. Slight fever has been known to follow the eating of decomposing substances or the drinking of stale beer; but the gastric juice has remarkable antiseptic properties, and the frequency with which persons take from choice articles which are "high," shows that poisoning is not likely to occur unless there is existing gastro-intestinal disturbance.

(*c*) Cases which follow exposure to foul odors or sewer-gas. That a febrile paroxysm may follow a prolonged exposure to noxious odors has long been recognized. The cases which have been described under this heading are of two kinds: an acute severe form with nausea, vomiting, colic, and fever, followed perhaps by a condition of collapse or coma; secondly, a form of low fever with or without chills. A good deal of doubt still exists in the minds of the profession about these cases of so-called sewer-gas poisoning. It is a notorious fact that workers in sewers are remarkably free from disease, and in many of the cases which have been reported the illness may have been only a coincidence. There are instances in which persons have been taken ill with vomiting and slight fever after exposure to the odor of a very offensive post-mortem. Whether true or not, the idea is firmly implanted in the minds of the laity that very powerful odors from decomposing matters may produce sickness.

(*d*) Many cases doubtless depend upon slight unrecognized lesions, such as tonsillitis or occasionally an abortive or larval pneumonia. Children are much more frequently affected than adults.

The *symptoms* set in, as a rule, abruptly, though in some instances there may have been preliminary *malaise* and indisposition. Headache,

The investigations of Jaeger render it not impossible that this epidemic form of jaundice depends upon infection with a proteus — bacillus proteus fluorescens. (Zeitschrift fur Hygiene, Bd. 12).

loss of appetite, and furred tongue are present. The urine is scanty and high-colored, the fever ranges from 101° to 103°, sometimes in children it rises higher. The cheeks may be flushed and the patient has the outward manifestations of fever. In children there may be bronchial catarrh with slight cough. Herpes on the lips is a common symptom. Occasionally in children the cerebral symptoms are marked at the outset, and there may be irritation, restlessness, and nocturnal delirium. The fever terminates abruptly by crisis from the second to the fourth day; in some instances it may continue for a week.

The *diagnosis* generally rests upon the absence of local manifestations, particularly the characteristic skin rashes of the eruptive fevers, and most important of all the rapid disappearance of the pyrexia. The cases most readily recognized are those with acute gastro-intestinal disturbance.

The *treatment* is that of mild pyrexia—rest in bed, a laxative, and a fever mixture containing nitrate of potash and sweet spirits of nitre.

(2) WEIL'S DISEASE.

Acute Febrile Icterus.—In 1886 Weil described an acute infectious disease, characterized by fever and jaundice. Much discussion has taken place concerning the true nature of this affection, but it has not been definitely determined whether it is a specific disease or only a jaundice which may be due to various causes. The majority of the cases have occurred during the summer months. The cases have occurred in groups in different cities. A few cases have been reported in this country (Lanphear). Males are most frequently affected. Many of the cases have been in butchers. The age of the patients has been from twenty-five to forty.

The disease sets in abruptly, usually without prodromata, and often with a chill. There are headache, pains in the back, and sometimes intense pains in the legs and muscles. The fever is characterized by marked remissions. Jaundice appears early. The liver and spleen are usually swollen; the former may be tender. The jaundice may be light, but in many of the cases described it has been of the obstructive form, and the stools have been clay-colored. Gastro-intestinal symptoms are rarely present. The fever lasts from ten to fourteen days; sometimes there are slight recurrences, but a definite relapse is rare.

Albumen is usually present in the urine; hæmaturia has occurred in some cases.

Cerebral symptoms, delirium and coma, have been met.

In the few post-mortems which have been made nothing distinctive has been found. Its occurrence as an independent malady, apart from other infectious processes, has scarcely yet been definitely established.

(3) MILK-SICKNESS.

This remarkable disease prevails in certain districts of the United States, west of the Alleghany Mountains, and is connected with the affection in cattle known as the *trembles*. It prevailed extensively in the early settlements in certain of the Western States and proved very fatal. The general opinion is that it is communicated to man only by eating the flesh or drinking the milk of diseased animals. The butter and cheese are also poisonous. In animals, cattle and the young of horses and sheep are most susceptible. It is stated that cows giving milk do not themselves show marked symptoms unless driven rapidly, and, according to Graff, the secretion may be infective when the disease is latent. When a cow is very ill, food is refused, the eyes are injected, the animal staggers, the entire muscular system trembles, and death occurs in convulsions, sometimes with great suddenness. Nothing definite is known as to the cause of the disease. It is most frequent in new settlements.

In man the symptoms are those of a more or less acute intoxication. After a few days of uneasiness and distress the patient is seized with pains in the stomach, nausea and vomiting, fever and intense thirst. There is usually obstinate constipation. The tongue is swollen and tremulous, the breath is extremely foul and, according to Graff, is as characteristic of the disease as the odor is of small-pox. Cerebral symptoms—restlessness, irritability, coma, and convulsions—are sometimes marked, and there may gradually be produced a typhoid state in which the patient dies.

The duration of the disease is variable. In the most acute forms death occurs within two or three days. It may last for ten days, or even for three or four weeks. Graff states that insanity occurred in one case. The poisonous nature of the flesh and of the milk has been demonstrated experimentally. An ounce of butter or cheese, or four ounces of the beef, raw or boiled, three times a day will kill a dog within six days. No definite pathological lesions are known. Fortunately, the disease has become rare, and the observation of Drake, Yandell, and others, that the disease gradually disappears with the clearing of the forests and improved tillage, has been amply substantiated. It still prevails in parts of North Carolina.

(4) MALTA FEVER.

This disease, also known as Mediterranean fever, Neapolitan fever, and rock fever, has been studied particularly by the naval and military medical officers who have been stationed on the island of Malta. It prevails also in Naples and other districts of the Mediterranean. While endemic in the island of Malta, the disease in some years reaches epidemic proportions. Young persons are, as a rule, affected. The incubation may be from six to ten days.

The *symptoms* are thus briefly and clearly described in an editorial in

the British Medical Journal: "The disease declares itself gradually, with headache, sleeplessness, loss of appetite, and thirst, often without shivering or diarrhœa, and without spots. Symptoms of this kind, with more or less severity, last for three or four weeks; apparent but deceptive convalescence then usually sets in, to be followed in a few days by a relapse, with rigors, intense headache and fever, with, frequently, diarrhœa. In this state the patient may continue for five or six weeks, with more or less delirium. Improvement again sets in, to be followed, it may be, by another relapse in about ten days or a fortnight, with shivering, headache, sleeplessness, great debility, with night-sweats, pains in the hips, knees, ankles, and elbows, and often in one or both testicles. Again, the patient enters on a state of convalescence, which may last for a month or six weeks. The old symptoms may again appear, with extreme debility, a thickly coated tongue, with thirst, a temperature ranging from 105° Fahr. in the evening to nearly normal in the morning, with night-sweats bringing no relief to the general distress. The rheumatic symptoms are the most constant and the most distressing; all the joints, large and small, may suffer. Dr. Veale described cases in which the intervertebral joints, especially those of the lumbar region and the sacro-iliac synchondroses, were so severely affected that the patient "dreads every movement"; he will lie for days in one position, risking the formation of bed-sores, and resisting the desire to evacuate his bowels rather than encounter the suffering that a movement will entail. Oftentimes the tendo Achillis and the [illegible] structures around [illegible] become involved, [illegible] from the sacral plexus are still more commonly affected."*

The nature of the disease is still under discussion. Mclean, of the Army Medical Corps, in 1878, suggested that it was a septic typhoid fever, and called it *febris complicata*. Others have supposed that it is an anomalous form of malaria, but it does not behave like any ordinary form of paludal fever and resists quinine. This is a question which could be determined positively by the blood examination. According to Bruce, no characteristic typhoid lesions are found in fatal cases. This author has described the presence of a micrococcus in the spleen. The Italian observers have noted enlargement of the mesenteric glands and Cantani regards it as an adeno-typhoid. The identity of Malta and the so-called fever of Gibraltar is, however, by no means certain. The [illegible] of the Journal referred to, Surgeon Parry states that he made a hundred autopsies during four years in Gibraltar, in cases of the so-called rock fever, in not one were the typical lesions of typhoid absent. On the other hand, it is held to be a fever due to chronic poisoning with fecal emanations.

Fortunately, the mortality is not great. With reference to the treat-

* British Medical Journal, vol. i, 1889.

The ~~disease is~~ affection is distinct from either typhoid fever or malaria. The mortality is about two per cent.

The researches of Hughes confirm the observations of Bruce and the Micrococcus Melitensis as it is called has been obtained in pure cultures & in six cases the disease has been reproduced in monkeys

the British Medical Journal*: "The disease declares itself gradually, with headache, sleeplessness, loss of appetite, and thirst, often without shivering or diarrhœa, and without spots. Symptoms of this kind, with more or less severity, last for three or four weeks; apparent but deceptive convalescence then usually sets in, to be followed in a few days by a relapse, with rigors, intense headache and fever, with, frequently, diarrhœa. In this state the patient may continue for five or six weeks, with more or less delirium. Improvement again sets in, to be followed, it may be, by another relapse in about ten days or a fortnight, with shivering, headache, sleeplessness, great debility, with night-sweats, pains in the hips, knees, ankles, and elbows, and often in one or both testicles. Again, the patient enters on a state of convalescence, which may last for a month or six weeks. The old symptoms may again appear, with extreme debility, a thickly coated tongue, with thirst, a temperature ranging from 105° Fahr. in the evening to nearly normal in the morning, with night-sweats bringing no relief to the general distress. The rheumatic symptoms are the most constant and the most distressing; all the joints, large and small, may suffer. Dr. Veale described cases in which the intervertebral joints, especially those of the lumbar region and the sacro-iliac synchondroses, were so severely affected that the patient "dreads every movement"; he will lie for days in one position, risking the formation of bed-sores, and resisting the desire to evacuate his bowels rather than encounter the suffering that a movement will entail. Oftentimes the tendo Achillis and the fibrous structures around the ankle-joint are involved; but perhaps the lumbar aponeuroses and the sheaths of the nerves issuing from the sacral plexus are still more commonly affected."*

The nature of the disease is still under discussion. McLean, of the Army Medical School, in 1879, suggested that it was a typho-malarial fever, and Veale called it *febris complicata*. Others have supposed that it is an anomalous form of malaria, but it does not behave like any ordinary form of paludal fever and resists quinine. This is a question which could be determined positively by the blood examination. According to Bruce, no characteristic typhoid lesions are found in fatal cases. This author has described the presence of a micrococcus in the spleen. The Italian observers have noted enlargement of the mesenteric glands, and Cantani regards it as an adeno-typhoid. The identity of Malta and the so-called rock fever of Gibraltar is, however, by no means certain. In the number of the Journal referred to, Surgeon Perry states that of about a hundred autopsies during four years in Gibraltar, in cases of the so-called rock fever, in not one were the typical lesions of typhoid absent. On the other hand, it is held to be a fever due to chronic poisoning with fæcal emanations.

Fortunately, the mortality is not great. With reference to the treat-

* British Medical Journal, vol. i, 1889.

ment Bruce concludes that it should be directed principally to keeping the patient's strength up by fluid, easily digested food, by stimulants when required and by attention to ordinary hygienic principles. The removal of the patient from the infected area does not cut short the fever.

(5) MOUNTAIN FEVER.

Residence for a time at a high altitude is in some instances followed by a group of symptoms to which the term mountain sickness or mountain fever has been given. Several distinct diseases have undoubtedly been described. It is by no means certain that there is a special affection to which the term may be applied. An important group, the *mountain anæmia*, is associated with the *anchylostoma*, which has not yet been met with in this country. A second group of cases belongs unquestionably to typhoid fever, and undoubted instances of this disease occurring in mountainous regions in the West are referred to as mountain fever.

In the very full and clear report which Hoff * gives of five cases, the clinical picture is that of typhoid fever, and one of the patients died of perforation of the ileum with well-defined typhoid lesion. Even from the clinical reports, unless biased by notions of a rigidly characteristic picture of the disease, one might have said that all of Surgeon Hoff's cases were typhoid fever, and the post-mortem record leaves no question as to the nature of the malady. Woodward, commenting upon this communication, states that there is in the United States Army Medical Museum a second specimen from the case of so-called mountain fever contributed by Surgeon Girard.

Smart, who reviewed the entire question a few years ago, regarded the disease as a typho-malarial fever; but there is nothing in his account opposed to the opinion that it is a typhoid fever.

There is a third group to which, perhaps, alone the term mountain sickness should be applied—cases which present respiratory and cardiac symptoms, due to a high altitude. The pulse is rapid, there are giddiness, headache, sometimes nausea and vomiting, sensations of great prostration, and considerable respiratory distress. The original cases described by General Fremont were of this nature.

(6) MILIARY FEVER—SWEATING SICKNESS.

The disease is characterized by fever, profuse sweats, and an eruption of miliary vesicles. The disease prevailed and was very fatal in England in the fifteenth and sixteenth centuries, but of late years it has been confined entirely to certain districts in France (Picardy) and Italy. An epidemic of some extent occurred in France in 1887. Hirsch gives a

* American Journal of the Medical Sciences, January, 1880.

see Erysipelas (in South Amer. travel.)
" Mountain Fever

chronological account of 194 epidemics between 1718 and 1879, many of which were limited to a single village or to a few localities. Occasionally the disease has become widely spread. Slight epidemics have occurred in Germany and Switzerland. They are usually of short duration, lasting only for three or four weeks—sometimes not more than seven or eight days. As in influenza, a very large number of persons are attacked in rapid succession. In the mild cases there is only slight fever, with loss of appetite, an erythematous eruption, profuse perspiration, and an outbreak of miliary vesicles. The severe cases present the symptoms of intense infection—delirium, high fever, profound prostration, and hæmorrhage. The death-rate at the outset of the disease is usually high, and, as is so graphically described in the account of some of the epidemics of the middle ages, death may follow in a few hours.

(7) Foot and mouth Disease

(8) Beri-beri.

(9) Saville's Disease

SECTION II.

CONSTITUTIONAL DISEASES.

I. RHEUMATIC FEVER.

Definition.—An acute, non-contagious, febrile affection, depending probably upon an unknown infective agent, and characterized by multiple arthritis and a special tendency to involve the heart.

Etiology.—Acute rheumatism prevails in temperate and in humid climates. It is rare in the tropics. Statistics on the point are not available, but, judging from my own observations, I think that, in hospital practice at least, cases are much more frequent in England than in America. It prevails most extensively during the spring months. In Bell's statistics, of 456 cases treated at the Montreal General Hospital during ten years, the largest number of cases were admitted in February, March, and April. The same proportion seems true in Europe and in the cities of the Atlantic coast.

Age.—Young adults are most frequently affected, but the disease is by no means uncommon in children between the ages of ten and fifteen years. Sucklings are rarely affected, and probably many of the cases which have been described belong to a totally different affection, the arthritis of infants. In exceptional cases, however, true rheumatism does occur. The following age table is based upon 456 cases admitted to the Montreal General Hospital: Under 15 years, 4·38 per cent; from 15 to 25 years, 48·68 per cent; from 25 to 35 years, 25·87 per cent; from 35 to 45 years, 13·6 per cent; above 45 years, 7·4 per cent. Of the 655 cases analyzed by Whipham for the Collective Investigation Committee of the British Medical Association, only 32 cases occurred under the tenth year and 80 per cent between the twentieth and fortieth year. These figures scarcely give the ratio of cases in children.

Sex.—If all ages are taken, males are affected oftener than females. In the Collective Investigation Report there were 375 males and 279 females. Up to the age of twenty, however, females predominate. Between the ages of ten and fifteen girls are more prone to the disease.

Occupations which necessitate exposure to cold and to great changes

Newsholme (Milroy Lectures. 1895) concludes that the disease occurs in epidemics without regular periodicity but which recur at intervals of three four or six years, that they vary much in intensity a severe epidemic is apt to be followed by two or three light outbreaks.

Sahli has found an organism resembling the staphylococcus citreus but of low virulence, and Leyden a diplococcus differing from that of pneumonia (D. m. W. 1894)

in temperature predispose strongly to rheumatism. We meet the disease oftenest in drivers, servants, bakers, sailors, and laborers. Heredity seems in some cases to have a special influence, and the disease is more common in certain families. Of all etiological factors, cold is believed to be the most potent. Many cases follow a sudden wetting or chilling of the skin.

The essential cause of rheumatism is still unknown. There are three chief theories:

(*a*) *Metabolic:* that it depends upon a morbid material produced within the system in defective processes of assimilation. It has been suggested that this material is lactic acid (Prout) or certain combinations with lactic acid (Latham). Our knowledge of the chemical relations of the various products produced in the regressive nutritive changes is too limited to base much reliance upon these views. Richardson claims to have produced rheumatism by injecting lactic acid and by its internal administration.

(*b*) The *nervous theory* advanced by J. K. Mitchell has many advocates. According to this view, either the nerve-centres are primarily affected by cold and the local lesions are really trophic in character, or the primary nervous disturbance leads to errors in metabolism and the accumulation of lactic acid in the system. The advocates of this view regard as analogous the arthropathies of myelitis, locomotor ataxia, and chorea.

(*c*) *Germ theory:* that the arthritis is due to a specific microbe. In favor of this view may be mentioned the close analogy which exists between rheumatism and certain of the infectious diseases. The analogy is marked with gonorrhœa, scarlet fever, and septic processes, which are frequently associated with arthritis and endocarditis. The investigations hitherto made have not, however, shown the constancy of any microorganism in the disease. Mantle and others have described micrococci in the blood, and several organisms have been found in the secondary inflammations of the disease, but none of them can be said to be specific or peculiar.

Morbid Anatomy.—There are no changes characteristic of the disease. The affected joints show hyperæmia and swelling of the synovial membranes and of the ligamentous tissues. There may be slight erosion of the cartilage. The fluid in the joint is turbid, albuminous in character, and contains leucocytes and a few fibrin flakes. Pus is very rare in uncomplicated cases. Rheumatism rarely proves fatal, except when there are serious complications, such as pericarditis, endocarditis, myocarditis, pleurisy, or pneumonia. The conditions found have nothing peculiar, nothing to distinguish them from other forms of inflammation. In death from hyperpyrexia no special changes occur. The blood usually contains an excessive amount of fibrin. In the secondary rheumatic inflammations, as pleurisy and pericarditis, various pus organisms have been found, possibly the result of a mixed infection.

Symptoms.—As a rule, the disease sets in abruptly, but it may be preceded by irregular pains in the joints, slight *malaise*, sore throat, and particularly by tonsillitis. A definite rigor is uncommon; more often there is slight chilliness. The fever rises quickly, and with it one or more of the joints become painful. Within twenty-four hours from the onset, the disease is fully developed. The temperature range is from 102° to 104°. The pulse is frequent, soft, and usually above 100. The tongue is moist, and rapidly becomes covered with a white fur. There are the ordinary symptoms associated with an acute fever, such as loss of appetite, thirst, constipation, and a scanty, highly acid, highly colored urine. In a majority of the cases there are profuse, very acid sweats, of a peculiar sour odor. Sudaminal and miliary vesicles are abundant. The mind is clear, except in the cases with hyperpyrexia. The affected joints are painful to move, and soon become swollen and hot, and present a reddish flush. The knees, ankles, elbows, and wrists are the joints usually attacked, not together, but successively. For example, if the knee is first affected, the redness may disappear from it as the wrists become painful and hot. The disease is seldom limited to a single articulation. The amount of swelling is variable. Extensive effusion into a joint is rare, and much of the enlargement is due to the infiltration of the periarticular tissues with serum. The swelling may be limited to the joint proper, but in the wrists and ankles it sometimes involves the sheaths of the tendons and produces great enlargement of the hands and feet. Corresponding joints are often affected. In attacks of great severity every one of the larger joints may be involved. The vertebral, sterno-clavicular, and phalangeal articulations are less often inflamed in acute than in gonorrhœal rheumatism. Perhaps no disease is more painful than acute polyarthritis. The inability to change the posture without agonizing pain, the drenching sweats, the prostration and utter helplessness, combine to make it one of the most distressing of febrile affections. A special feature of the disease is the tendency of the inflammation to subside in one joint while developing with great intensity in another.

The temperature range in an ordinary attack is between 102° and 104°. It is peculiarly irregular, with marked remissions and exacerbations, depending very much upon the intensity and extent of the articular inflammation. Defervescence is usually gradual. The profuse sweats materially influence the temperature curve. If a two-hourly chart is made and observations upon the sweats are noted, the remissions will usually be found coincident with the sweats. The perspiration is sour-smelling and acid at first; but, when persistent, becomes neutral or even alkaline.

The blood is profoundly and rapidly altered in acute rheumatism. There is, indeed, no acute febrile disease in which the anæmia develops with greater rapidity.

With the high fever a murmur may often be heard at the apex region. Endocarditis is also a common cause of an apex *bruit*. The heart

should be carefully examined at the first visit and subsequently each day.

The urine is, as a rule, reduced in amount, of high density and high color. It is very acid, and, on cooling, deposits urates. The chlorides may be greatly diminished or even absent. Febrile albuminuria is not uncommon.

The saliva may become acid in reaction and is said to contain an excess of sulphocyanides.

Subacute Rheumatism.

This represents a milder form of the disease, in which all the symptoms are less pronounced. The fever rarely rises above 101°; fewer joints are involved; and the arthritis is less intense. The cases may drag on for weeks or months, and the disease may finally become chronic. It should not be forgotten that in children this mild or subacute form may be associated with endocarditis or pericarditis.

Complications.—These are important and serious.

(1) **Hyperpyrexia.**—The temperature may rise rapidly a few days after the onset, and be associated with delirium; but not necessarily, for the temperature may rise to 108° or, as in one of Da Costa's cases, 110°, without cerebral symptoms. The delirium may precede or follow the onset of the hyperpyrexia. As a rule, with the high fever, the pulse is feeble and frequent, the prostration is extreme, and finally stupor supervenes.

(2) **Cardiac Affections.**—(*a*) *Endocarditis*, the most frequent and serious complication, occurs in a considerable percentage of all cases. The statistics upon this point are not of much value, as the diagnosis has been based, as a rule, upon the development of a systolic murmur at apex or base. This is quite untrustworthy; since it may depend upon causes other than endocarditis. The mitral segments are most frequently involved and the affection is usually of the simple, verrucose variety. Ulcerative endocarditis in the course of acute rheumatism is very rare. Of 209 cases of this disease which I analyzed, in only 24 did the symptoms of a severe endocarditis arise during the progress of acute or subacute rheumatism. This complication, in itself, is rarely dangerous. It produces few symptoms and is usually overlooked. Unhappily, though the valve at the time may not be seriously damaged, the inflammation starts changes which lead to sclerosis and retraction of the segments, and so to chronic valvular disease.

(*b*) *Pericarditis* may occur independently of or together with endocarditis. It may be simple fibrinous, sero-fibrinous, or in children purulent. Clinically we meet it more frequently in connection with rheumatism than all other affections combined. The physical signs are very characteristic. The condition will be fully described under its appropriate section. A peculiar form of delirium may develop during the progress of rheumatic pericarditis.

(*c*) *Myocarditis* is most frequent in connection with endo-pericardial changes. The anatomical condition is a granular or fatty degeneration of the heart-muscle, which leads to weakening of the walls and to dilatation. It is not, I think, nearly so common as the other cardiac affections. S. West has reported instances of acute dilatation of the heart in rheumatic fever, in one of which marked fatty changes were found in the heart-fibres.

(3) **Pulmonary Affections.**—Pneumonia and pleurisy are not uncommon, and frequently accompany the cases of endo-pericarditis. According to Howard's analysis of a large number of cases, there were pulmonary complications in only 10·5 per cent of cases of rheumatic endocarditis; in 58 per cent of cases of pericarditis; and in 71 per cent of cases of endo-pericarditis. Congestion of the lung is occasionally found, and in several cases has proved rapidly fatal.

(4) **Cerebral Complications.**—These are due, in part, to the hyperpyrexia and in part to the special action upon the brain of the toxic agent of the disease. They may be grouped as follows: (*a*) *Delirium.* This is usually associated with the hyperpyrexia, but may be independent of it. It may be active and noisy in character; more rarely a low muttering delirium, passing into stupor and coma. Special mention must be made of the delirium which occurs in connection with rheumatic pericarditis. Delirium, too, may be excited by the salicylate of soda, either shortly after its administration, or more commonly a week or ten days later. (*b*) *Coma*, which is more serious, may develop without preliminary delirium or convulsions, and may prove rapidly fatal. Certain of these cases are associated with hyperpyrexia; but Southey has reported the case of a girl who, without previous delirium or high fever, became comatose, and died in less than an hour. A certain number of such cases, as those reported by Da Costa, have been associated with marked renal changes and were evidently uræmic. The coma may develop during the attack, or after convalescence has set in. (*c*) *Convulsions* are less common, though they may precede the coma. Of 127 observations cited by Besnier, there were 37 of delirium, only 7 of convulsions, 17 of coma and convulsions, 54 of delirium, coma, and convulsions, and 3 of other varieties (Howard). (*d*) *Chorea.* The relations of this disease and rheumatism will be subsequently discussed. It is sufficient here to say that in only 88 out of 554 cases which I have analyzed from the Infirmary for Diseases of the Nervous System, Philadelphia, were chorea and rheumatism associated. It is most apt to develop in the slighter attacks in childhood. (*e*) *Meningitis* is extremely rare, though undoubtedly it does occur. It must not be forgotten that in ulcerative endocarditis, which is occasionally associated with acute rheumatism, meningitis is frequent.

(5) **Cutaneous Affections.**—Sweat-vesicles have already been mentioned as extremely common. A red miliary rash may also develop. Scarlatiniform eruptions are occasionally seen. Purpura, with or without urticaria,

may occur, and various forms of erythema. It is doubtful whether the cases of extensive purpura with urticaria and arthritis—peliosis rheumatica—belong truly to acute rheumatism.

(6) **Rheumatic Nodules.**—These curious structures, in the form of small subcutaneous nodules attached to the tendons and fasciæ, have been known for some years; but special attention has been paid to them of late, since their careful study by Barlow and Warner. They vary in size from a small shot to a large pea, and are most numerous on the fingers, hands, and wrists. They also occur about the elbows, knees, the spines of the vertebræ, and the scapulæ. They are not often tender. They do not necessarily come on during the fever, but may be found on its decline, or even independently altogether of an acute attack. They may develop with great rapidity and usually last for weeks or months. They are more common in children than in adults, and their presence may be regarded as a positive indication of rheumatism. They have been noted particularly in association with severe and chronic rheumatic endocarditis. They may occur in large numbers in adults, as in a case reported from my clinic in Philadelphia, by J. K. Mitchell. Histologically they are made up of round and spindle-shaped cells.

The *course* of acute rheumatism is extremely variable. It is, as Austin Flint first showed, a self-limited disease, and it is not probable that medicines have any special influence upon its *duration* or *course*. Gull and Sutton who likewise studied a series of sixty-two cases without special treatment arrived at the same conclusion.

Diagnosis.—Practically, the recognition of acute rheumatism is very easy; but there are several affections which, in some particulars, closely resemble it.

(1) **Multiple Secondary Arthritis.**—Under this term may be embraced the various forms of arthritis which come on or follow in the course of the infective diseases, such as gonorrhœa, scarlet fever, dysentery, and cerebro-spinal meningitis. Of these the gonorrhœal form will receive special consideration and is the type of the entire group.

(2) **Septic Arthritis,** which develops in the course of pyæmia from any cause, and particularly in puerperal fever. No hard and fast line can be drawn between these and the cases in the first group; but the inflammation rapidly passes on to suppuration and there is more or less destruction of the joints. The conditions under which the arthritis develops give a clew at once to the nature of the case. Under this section may also be mentioned:

(*a*) *Acute necrosis* or *acute osteo-myelitis*, occurring in the lower end of the femur, or in the tibia, and which may be mistaken for acute rheumatism. Sometimes, too, it is multiple. The greater intensity of the local symptoms, the involvement of the epiphyses rather than the joints, and the more serious constitutional disturbances are points to be considered. The condition is unfortunately often mistaken for acute arthritis, and, as

the treatment is essentially surgical, the error is one which may cost the life of the patient.

(*b*) *The acute arthritis of infants* must be distinguished from rheumatism. It is a disease which is usually confined to one joint (the hip or knee), the effusion in which rapidly becomes purulent. The affection is most common in sucklings and is undoubtedly pyæmic in character.* It may also develop in the gonorrhœal ophthalmia or vaginitis of the newborn, as pointed out by Clement Lucas.

(3) It is only in rare instances that gout and acute rheumatism are confounded. The localization in a single, usually a small, joint, the age, the history, the mode of onset—are features which enable us to recognize the cases readily.

Treatment.—The bed should have a smooth, soft, yet elastic mattress. The patient should wear a flannel night-gown, which may be opened all the way down the front and slit along the outer margin of the sleeves. Three or four of these should be made, so as to facilitate the frequent changes required after the sweats. He may wear also a light flannel cape about the shoulders. He should sleep in blankets, not in sheets, so as to reduce the liability to catch cold and obviate the unpleasant clamminess consequent upon heavy sweating. Chambers insisted that the liability to endocarditis and pericarditis was much reduced when the patients were in blankets.

Milk is the most suitable diet. It may be diluted with alkaline mineral waters. Lemonade and oatmeal or barley water should be freely given. The thirst is usually great and may be fully satisfied. There is no objection to broths and soups if the milk is not well borne. The food should be given at short and stated intervals. As convalescence is established a fuller diet may be allowed, but meat should be used sparingly.

The local treatment is of the greatest importance. It often suffices to wrap the affected joints in cotton. If the pain is severe, hot cloths may be applied, saturated with Fuller's lotion (carbonate of soda, 6 drachms; laudanum, 1 oz.; glycerine, 2 oz.; and water, 9 oz.). Tincture of aconite or chloral may be employed in an alkaline solution. Chloroform liniment is also a good application. Fixation of the joints is of great service in allaying the pain. I have seen, in a German hospital, the joints enclosed in plaster of Paris, apparently with great relief. Splints, padded and bandaged with moderate firmness, will often be found to relieve pain. Friction is rarely well borne in an acutely inflamed joint. Cold compresses are much used in Germany. The application of blisters above and below the joint, often relieves the pain. This method, which was used so much a few years ago, is not to be compared with the light application of the Paquelin thermo-cautery.

Medicines have little or no control over the duration or course of the

* Townsend, Acute Arthritis of Infants, American Journal of the Medical Sciences, January, 1890.

disease, which, like other self-limited affections, practically takes its own time to disappear. Salicyl compounds, which were regarded so long as specific in the disease, are now known to act chiefly by relieving pain. R. P. Howard's elaborate analysis shows that they do not influence the duration of the disease. Nor do they prevent the occurrence of cardiac complications, while under their use relapses are considerably more frequent than in any other method of treatment. In acute cases with severe pain the salicyl compounds give prompt relief and rarely disappoint us in their action. Sodium salicylate, in fifteen-grain doses for eight or ten doses, may be given. The bicarbonate of potassium in twenty-grain doses may be used with it. Many prefer salicin (gr. 20) in wafers; others the salicylic acid (gr. 20) or salol. I have for the past five or six years used the oil of wintergreen, recommended by Kinnicutt, and have found it quite as efficacious. Twenty minims may be given every two hours in milk. The salicyl compounds are best given in full doses at the outset of the disease, to relieve the pain. Then the dose should be reduced in frequency, or, if the symptoms have abated, stopped altogether, as relapses are certainly more frequent under their use.

Alkalies may be combined with the salicylates, or may be used alone. The potassium bicarbonate in half-drachm doses may be given every three or four hours until the urine is rendered alkaline. Fuller, who so warmly supported this method of treatment, was in the habit of ordering a drachm and a half of the sodium bicarbonate with half a drachm of potassium acetate in three ounces of water, rendered effervescent at the time of administration by half a drachm of citric acid or an ounce of lemon-juice. This is given every three or four hours, and usually by the end of twenty-four hours the urine is alkaline in reaction. The alkali is then reduced, and the amount subsequently regulated by the degree of acidity of the urine, only enough being given to keep the secretion alkaline. Opinion is almost unanimous that, under the alkaline treatment, cardiac complications are less common. The combination of the salicylates with the alkali is probably the most satisfactory. Care must be taken to watch the heart during the administration of these remedies. In the only fatal case of rheumatism which has come in my experience the patient had, owing to an error, taken the full first day's dose of Fuller's alkaline treatment for five successive days, instead of having the salt gradually reduced. She died suddenly on the fifth day after sitting up in bed. Salicylates also, if given largely, are very depressing to the circulation.

To allay the pain opium may be given in the form of Dover's powder, or morphia hypodermically. Antipyrin, antifebrin, and phenacetin are useful sometimes for the purpose. During convalescence iron is indicated in full doses, and quinine is a useful tonic. Of the complications, hyperpyrexia should be treated by the cold bath or the cold-pack. The treatment of endocarditis and pericarditis and the pulmonary complications will be considered under their respective sections.

II. CHRONIC RHEUMATISM.

Etiology.—This affection may follow an acute or subacute attack, but more commonly comes on insidiously in persons who have passed the middle period of life. In my experience it is extremely rare as a sequence of acute rheumatism. It is most common among the poor, particularly washer-women, day laborers, and those whose occupation exposes them to cold and damp.

Morbid Anatomy.—The synovial membranes are injected, but there is usually not much effusion. The capsule and ligaments of the joints are thickened, and the sheaths of the tendons in the neighborhood undergo similar alterations, so that the free play of the joint is greatly impaired. In long-standing cases the cartilages also undergo changes, and may show erosions. Even in cases with the severest symptoms, the joint may be very slightly altered in appearance. Important changes take place in the muscles and nerves adjacent to chronically inflamed joints, particularly in the mono-articular lesions of the shoulder or hip. Muscular atrophy supervenes partly from disuse, partly through nervous influences, either centric or reflex (Vulpian), or as a result of peripheral neuritis. In some cases when the joint is much distended the wasting may be due to pressure, either on the muscles themselves or on the vessels supplying them.

Symptoms.—Stiffness and pain are the chief features of chronic rheumatism. The latter is very liable to exacerbations, especially during changes in the weather. The joints may be tender to the touch and a little swollen, but seldom reddened. As a rule, many joints are affected; but there are instances in which the disease is confined to one shoulder, knee, or hip. The stiffness and pain are more marked after rest, and as the day advances the joints may, with exertion, become much more supple. The general health may not be seriously impaired. The disease is not immediately dangerous. Anchylosis may occur, and ultimately the joints may become very distorted. In many instances, particularly those in which the pain is severe, the general health may be seriously involved and the subjects become anæmic and very apt to suffer with neuralgia and dyspepsia. Valvular lesions, due to slow sclerotic changes, are not uncommon. They are associated with, not dependent upon, the articular disease.

The *prognosis* is not favorable, as a majority of the cases resist all methods of treatment. It is, however, a disease which persists indefinitely, and does not necessarily shorten life.

Treatment.—Internal remedies are of little service. It is important to maintain the digestive functions and to keep the general health at a high standard. Iodide of potassium, sarsaparilla, and guaiacum are sometimes beneficial. The salicylates are useless.

Local treatment is very beneficial. "Firing" with the Paquelin cautery relieves the pain, and it is perhaps the best form of counter-

arthritis

It may arise in newly married women infected by an old beau of the husband.

irritation. Massage, with passive motion, helps to reduce swelling, and prevents anchylosis. It is particularly useful in cases which are associated with atrophy of the muscles. Electricity is not of much benefit. Climatic treatment is very advantageous. Many cases are greatly helped by prolonged residence in southern Europe or southern California. Rich patients should always winter in the South, and in this way avoid the cold, damp weather.

Hydrotherapeutic measures are specially beneficial in chronic rheumatism. Great relief is afforded by wrapping the affected joints in cold cloths, covered with a thin layer of blanket, and protected with oiled silk. The Turkish bath is useful, but the full benefit of this treatment is rarely seen except at bathing establishments. The hot alkaline waters are particularly useful, and a residence at the Hot Springs of Virginia or Arkansas, or at Banff, in the Rocky Mountains, on the Canadian Pacific Railway, will sometimes cure even obstinate cases.

III. PSEUDO-RHEUMATIC AFFECTIONS.

These are numerous, and occur as complications or sequelæ of many infectious diseases with which they have been considered. The one which is of most importance, and which, though a surgical affection, is usually treated of in works on medicine, is—

Gonorrhœal Rheumatism.—Though custom has sanctioned this term, the affection here considered has probably nothing whatever to do with rheumatism, but is an arthritis or synovitis of a septic nature, due to infection from the urethral discharge. It occurs either during an acute attack of gonorrhœa, or, more commonly, as the attack subsides, or when it has become chronic. It is far more frequent in men than in women. It is liable to recur, and is an affection of extraordinary obstinacy. It may involve many joints, but the knees and ankles are most commonly affected. It is peculiar in attacking certain joints which are rarely involved in acute rheumatism—as the sterno-clavicular, the intervertebral, the temporo-maxillary, and the sacro-iliac.

The *anatomical changes* are variable. The inflammation is often periarticular, and extends along the sheaths of the tendons. When effusion occurs in the joints it rarely becomes purulent. It has more commonly the characters of a synovitis. About the wrist and hand suppuration sometimes occurs in the sheaths. In the bacteriological examination the gonococci have been found in the exudate, but not invariably. They may be present in the tissues, however, and cause an effusion which may be sterile. It has been suggested that the simple arthritis or synovitis follows absorption of ptomaines from the urethral discharge, while the more severe suppurating forms are due to infection with pus organisms.

The *symptoms* of this disease are very variable. R. P. Howard recognized five clinical forms:

(*a*) *Arthralgic*, in which there are wandering pains about the joints, without redness or swelling. These persist for a long time.

(*b*) *Rheumatic*, in which several joints become affected, just as in subacute articular rheumatism. The fever is slight; the local inflammation may fix itself in one joint, but more commonly several become swollen and tender. In this form cerebral and cardiac complications may occur.

(*c*) *Acute gonorrhœal arthritis*, in which a single articulation becomes suddenly involved. The pain is severe, the swelling extensive, and due chiefly to peri-articular œdema. The general fever is not at all proportionate to the intensity of the local signs. The affection usually resolves, though suppuration occasionally supervenes.

(*d*) *Chronic Hydrarthrosis.*—This is usually mono-articular, and is particularly apt to involve the knee. It comes on often without pain, redness, or swelling. Formation of pus is rare. It occurred only twice in ninety-six cases tabulated by Nolen.

(*e*) *Bursal and Synovial Form.*—This attacks chiefly the tendons and their sheaths and the bursæ and the periosteum. The articulations may not be affected. The bursæ of the patella, the olecranon, and the tendo Achillis are most apt to be involved.

The disease is much more intractable than ordinary rheumatism, and relapses are extremely common. It may become chronic and last for years. A patient under my care, at the University Hospital, Philadelphia, was practically bedridden for nearly ten years with his first attack, and was carried from one health resort to another without getting much benefit. He finally recovered sufficiently to resume work, and enjoyed fair health for more than a year. Then he unfortunately had another attack of gonorrhœa. The multiple arthritis recurred, and when he came under my observation he had been ill nearly two years.

Complications.—Iritis is not infrequent and may recur with successive attacks. The visceral complications are rare. Endocarditis, pericarditis, and pleurisy may occur. R. L. MacDonnell recently analyzed twenty-seven cases of gonorrhœal rheumatism at the Montreal General Hospital, of which four presented signs of recent cardiac disease. Gluzinski has collected thirty-one cases from the literature. The endocarditis is usually simple, but occasionally there is an intense infection and ulcerative endocarditis with symptoms resembling typhoid fever.

Treatment.—The salicylates are of very little service, nor do they often relieve the pains in this affection. Iodide of potassium has also proved useless in my hands, even given in large doses. A general tonic treatment seems much more suitable—quinine, iron, and, in the chronic cases, arsenic.

The local treatment of the joints is very important. The thermocautery may be used to allay the pain and reduce the swelling. In acute

In a recent case in many wounds the gonococci were cultivated from the blood during life

cases, fixation of the joints is very beneficial, and in the chronic forms, massage and passive motion. The surgical treatment of this affection, as carried out nowadays, is more satisfactory, and I have seen strikingly good results follow incision and irrigation.

IV. MUSCULAR RHEUMATISM (*Myalgia*).

Definition.—A painful affection of the voluntary muscles and of the fasciæ and periosteum to which they are attached. The affection has received various names, according to its seat, as torticollis, lumbago, pleurodynia, etc.

Etiology.—The attacks follow cold and exposure, the usual conditions favorable to the development of rheumatism. It is by no means certain that the muscular tissues are the seat of the disease. Many writers claim, perhaps correctly, that it is a neuralgia of the sensory nerves of the muscles. Until our knowledge is more accurate, however, it may be considered under the rheumatic affections.

It is most commonly met with in men, particularly those exposed to cold and whose occupations are laborious. It is apt to follow exposure to a draught of air, as from an open window in a railway carriage. A sudden chilling after heavy exertion may also bring on an attack of lumbago. Persons of a rheumatic or gouty habit are certainly more prone to this affection. One attack renders an individual more liable to another. It is usually acute, but may become subacute or even chronic.

Symptoms.—The affection is entirely local. The constitutional disturbance is slight, and, even in severe cases, there may be no fever. Pain is a prominent symptom. It may be constant, or may occur only when the muscles are drawn into certain positions. It may be a dull ache or a bruised pain, or sharp, severe, and cramp-like. It is often sufficiently intense to cause the patient to cry out. Pressure on the affected part usually gives relief. As a rule, myalgia is a transient affection, lasting from a few hours to a few days. Occasionally it is prolonged for several weeks. It is very apt to recur.

The following are the principal varieties:

(1) **Lumbago**, one of the most common and painful forms, affects the muscles of the loins and their tendinous attachments. It occurs chiefly in workingmen. It comes on suddenly, and in very severe cases completely incapacitates the patient, who may be unable to turn in bed or to rise from the sitting posture.

(2) **Stiff neck** or **torticollis** affects the muscles of the antero-lateral region of the neck. It is very common, and occurs most frequently in the young. The person holds the head in a peculiar manner, and rotates the whole body in attempting to turn it. Usually it is confined to one side. The muscles at the back of the neck may also be affected.

(3) **Pleurodynia** involves the intercostal muscles on one side, and in some instances the pectorals and serratus magnus. This is, perhaps, the most painful form of the disease, as the chest cannot be at rest. It is more common on the left than on the right side. A deep breath, or coughing, causes very intense pain, and the respiratory movements are restricted on the affected side. There may be pain on pressure, sometimes over a very limited area. It may be difficult to distinguish from intercostal neuralgia, in which affection, however, the pain is usually more circumscribed and paroxysmal, and there are tender points along the course of the nerves. It is sometimes mistaken for pleurisy, but careful physical examination readily distinguishes between the two affections.

(4) Among other forms which may be mentioned are **cephalodynia**, affecting the muscles of the head; **scapulodynia, omodynia**, and **dorsodynia**, affecting the muscles about the shoulder and upper part of the back. Myalgia may also occur in the abdominal muscles and in the muscles of the extremities.

Treatment.—Rest of the affected muscles is of the first importance. Strapping the side will sometimes completely relieve pleurodynia. No belief is more wide-spread among the public than the efficacy of porous plasters for muscular pains of all sorts, particularly those about the trunk. If the pain is severe and agonizing, a hypodermic of morphia gives immediate relief. For lumbago acupuncture is, in acute cases, the most efficient treatment. Needles of from three to four inches in length (ordinary bonnet-needles, sterilized, will do) are thrust into the lumbar muscles at the seat of the pain, and withdrawn after five or ten minutes. In many instances the relief is immediate, and I can corroborate fully the statements of Ringer, who taught me this practice, as to its extraordinary and prompt efficacy in many instances. The constant current is sometimes very beneficial. In many forms of myalgia the thermo-cautery gives great relief. In obstinate cases blisters may be tried. Hot fomentations are soothing, and at the outset a Turkish bath may cut short the attack. In chronic cases iodide of potassium may be used, and both guaiacum and sulphur have been strongly recommended. Persons subject to this affection should be warmly clothed, and avoid, if possible, exposure to cold and damp. In gouty persons the diet should be restricted and the alkaline mineral waters taken freely. Large doses of nux vomica are sometimes beneficial.

V. ARTHRITIS DEFORMANS (*Rheumatoid arthritis*).

Definition.—A chronic disease of the joints, characterized by changes in the cartilages and synovial membranes, with periarticular formation of bone and great deformity.

Etiology.—Long believed to be intimately associated both with gout

and rheumatism (whence the names rheumatic gout and rheumatoid arthritis), this close relationship seems now very doubtful, since in a majority of the cases no history of either affection can be determined. It is difficult to separate some cases from ordinary chronic rheumatism, but the multiple form has, in all probability, a nervous origin, as suggested by J. K. Mitchell. This view is based upon such facts as the association of the disease with shock, worry, and grief; the similarity of the arthritis to the arthropathies due to disease of the cord, as in locomotor ataxia; the symmetrical distribution of the lesions; the remarkable trophic changes which lead to alterations in the skin and nails, and occasionally to muscular wasting out of proportion to the joint mischief. Ord regards the disease as analogous to progressive muscular atrophy and due either to a primary lesion in the cord or to changes the result of peripheral irritation, traumatic, uterine, urethral, etc. The true nature of the disease is still obscure, but the neuro-trophic theory meets very many of the facts. Females are more liable to the disease than males. In Archibald E. Garrod's table of 500 cases there were 411 females and 89 males. It most commonly sets in between the ages of twenty and thirty, but it may begin as late as fifty. It occurs also in children; within the past five years there have been at my clinics four cases in children under twelve. The degree of deformity may be extreme even at this early age. Hereditary influences are not uncommon. In Garrod's cases there were in 216 instances a family history of joint disease. Seguin has reported the occurrence of three cases in children of the same family. It is stated that the disease is more common in families with phthisical history. It seems to be more frequent in women who have had ovarian and uterine trouble, or who are sterile. In this country acute rheumatism or gout in the forebears is rare. Mental worry, grief, and anxiety seem frequent antecedents. It is an affection quite as common in the rich as in the poorer classes, though in England and the continent the latter seem more prone to the disease. Though often attributed to cold or damp, and occasionally to injury, there is no evidence that these are efficient causes.

Morbid Anatomy.—The changes in the joints differ essentially from those of gout in the absence of deposits of urate of soda, and from chronic rheumatism by the existence of extensive structural alterations, particularly in the cartilages. We are largely indebted to the magnificent work of Adams for our knowledge of the anatomy of this disease. The changes begin in the cartilages and synovial membranes, the cells of which proliferate. The cartilage covering the joint undergoes a peculiar fibrillation, becomes soft, and is either absorbed or gradually thinned by attrition, thus laying bare the ends of the bone, which become smooth, polished, and eburnated. At the margins, where the pressure is less, the proliferating elements may develop into irregular nodules, which ossify and enlarge the heads of the bones, forming osteophytes which completely lock the joint. The periosteum may also form new bone. There is usu-

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ally great thickening of the ligaments, and finally complete anchylosis results. This is rarely, however, a true anchylosis, but is caused by the osteophytes and thickened ligaments. There are often hyperostosis and increase in the articular ends of the bone in length and thickness. In long-standing cases and in old persons there may, on the other hand, be great atrophy of the heads of the affected bones. The spongy substance becomes friable, and in the hip-joint the wasting may reach such an extreme grade that the articulating surface lies between the trochanters. This is sometimes called *morbus coxæ senilis*. The anatomical changes may lead to great deformity. The metacarpal joints are enlarged and thickened, and the fingers are deflected toward the ulnar side. The toes often show a similar deflection.

The muscles become atrophied, and in some cases the wasting reaches a high grade. Neuritis has been demonstrated in the nerves about the joints.

Symptoms.—Charcot makes a convenient division of the cases into Heberden's nodosities, the general progressive form, and the partial or mono-articular form.

Heberden's Nodosities.—In this form the fingers are affected, and little hard nodules develop gradually at the sides of the distal phalanges. They are much more common in women than in men. They begin usually between the thirtieth and fortieth year. The subjects may be in perfect health, though more commonly they have digestive troubles, neuralgia, or rheumatic pains, or have had gout. Although these nodules are usually regarded as gouty, in many cases no manifestations of this disease occur. Heberden did not lay any stress upon the association. In the early stage the joints may be swollen, tender, and slightly red, particularly when knocked. The attacks of pain and swelling may come on in the joints at long intervals or follow indiscretion in diet. The little tubercles at the sides of the dorsal surface of the second phalanx increase in size, and give the characteristic appearance to the affection. The cartilages also become soft, and the ends of the bones eburnated. The condition is not curable; but there is this hopeful feature—the subjects of these nodosities rarely have involvement of the larger joints. They have been regarded, too, as an indication of longevity. Charcot states that in women with these nodes cancer seems more frequent.

General Progressive Form.—This occurs in two varieties, acute and chronic. The *acute* form may resemble, at its outset, ordinary articular rheumatism. There is involvement of many joints; swelling, particularly of the synovial sheaths and bursæ; not often redness; but there is moderate fever. Howard describes this condition as most frequent in young women from twenty to thirty years of age, often in connection with recent delivery, lactation, or rapid child-bearing. Acute cases may develop at the menopause. It may also come on in children. "These patients suffer in their general health, become weak, pale, depressed in spirits, and lose

The nodosities ~~in these deformed~~ at the joints are known as Haygarthis nodosities

Heberden says "they have no connection with gout, being formed in persons who never had it.

~~Haygarthes nodosities~~

see Balfour on the Senile Heart

Urate of soda is never deposited (Garrod)

flesh. In several cases of this form marked intervals of improvement have occurred; the local disease has ceased to progress, and tolerable comfort has been experienced perhaps until pregnancy, delivery, or lactation again determine a fresh outbreak of the disease."

The *chronic* form is by far the most common. The joints are usually involved symmetrically. The first symptoms are pain on movement and slight swelling, which may be in the joint itself or in the peri-articular sheaths. In some cases the effusion is marked, in others slight. The local conditions vary greatly, and periods of improvement alternate with attacks of swelling, redness, and pain. At first only one or two joints are affected; usually the joints of the hands, then the knees and feet; gradually other articulations are involved, and in extreme cases every articulation in the body is affected. Pain is an extremely variable symptom. Some cases proceed to the most extreme deformity without pain; in others the suffering is very great, particularly at night and during the exacerbations of the disease. There are cases in which pain of an agonizing character is an almost constant symptom, requiring for years the use of morphia.

Gradually the shape of the joints is greatly altered, partly by the presence of osteophytes, partly by the great thickening of the capsular ligaments, and still more by the retraction of the muscles. In moving the affected joint crepitation can be felt, due to the eburnation of the articular surfaces. Ultimately the joints become completely locked, not by a true bony anchylosis, but by the osteophytes which form around the articular surfaces, like ring-bone in horses. There is also a spurious anchylosis, caused by the thickening of the capsular ligaments and fibrous adhesions. The muscles about the joints undergo important changes. Atrophy from disuse gradually supervenes, and contractures tend to flex the thigh upon the abdomen and the leg upon the thigh. There are cases with rapid muscular wasting, symmetrical involvement of the joints, and trophic changes, which strongly suggest a central origin. Numbness, tingling, pigmentation or glossiness of the skin, and onychia may be present. In extreme cases the patient is completely helpless, and lies on one side with the legs drawn up, the arms fixed, and all the articulations of the extremities locked. Fortunately, it often happens in these severe general cases that the joints of the hand are not so much affected, and the patient may be able to knit or to write, though unable to walk or to use the arms. It is surprising indeed how much certain patients with advanced arthritis deformans can accomplish. No one who had seen the beautiful models and microscopic preparations of the late H. D. Schmidt, of New Orleans, could imagine that he had been afflicted for years with a most extreme grade of this terrible disease. In many cases, after involving two or three joints, the disease becomes arrested, and no further development occurs. It may be limited to the wrists, or to the knees and wrists, or to the knees and ankles. A majority of the patients finally reach a

quiescent stage, in which they are free from pain and enjoy excellent health, suffering only from the inconvenience and crippling necessarily associated with the disease.

Coincident affections are not uncommon. In the active stage the patients are often anæmic and suffer from dyspepsia, which may recur at intervals. There is no tendency to involvement of the heart.

The **partial** or **mono-articular** form affects chiefly old persons, and is seen particularly in the hip, the knee, the spinal column, or shoulder. It is, in its anatomical features, identical with the general disease. In the hip and shoulder the muscles early show wasting, and in the hip the condition ultimately becomes that already described as *morbus coxæ senilis*. These cases seem not infrequently to follow an injury. They differ from the polyarticular form in occurring chiefly in men and at a later period of life. One of the most interesting forms affects the vertebræ, completely locking the articulations, and producing the condition known as *spondylitis deformans*. When the cervical spine is involved the head cannot be moved up and down, but is carried stiffly. Usually rotation can be effected. The dorsal and lumbar spines may also be involved, and the body cannot be flexed in the slightest degree. No other joints may be affected.

Diagnosis.—Arthritis deformans can rarely be mistaken for either rheumatism or gout. It is important to distinguish from the mono-articular form the local arthritis of the shoulder-joint which is characterized by pain, thickening of the capsule and of the ligaments, wasting of the shoulder-girdle muscles, and sometimes by neuritis. This is an affection which is quite distinct from arthritis deformans, and is, moreover, in a majority of cases curable.

Treatment.—Arthritis deformans is an incurable disease. In many cases, after involvement of two or three joints, the progress is arrested. Too often it invades successively all the articulations, and in ten, fifteen, or twenty years the crippling becomes general and permanent.

The best that can be hoped for is a gradual arrest. It is useless to saturate the patients with iodide of potassium, salicylates, or quinine. Arsenic seems to do good as a general tonic. The improvement may be marked if large doses of it are given. Iron should be used freely, if there is anæmia. Careful attention to the digestion, plenty of good food, and fresh air are important measures. Hydrotherapy, with carefully performed massage, is best for the alleviation of the pain, and may possibly restrain the progress of the affection. In early cases local improvement and often great gain in the general strength follow a prolonged treatment at the hot mineral baths; but the practitioner should exercise care in recommending this mode of treatment, which is of very doubtful value when the disease is well established. I have repeatedly known cases to be rendered much worse by residence at these institutions. When good results, it is largely from change of scene and climate, and the careful

An old recipe called the "Chelsea Pensioner," containing Sulphur ℥i; cream of tartar ℥i; Rhubarb ℥iv; Ginger Guaiacum ℥i; Honey ℥vi. (S. ℥i night & morning) in warm wine, was formerly much used.

regulation of the diet. The local treatment is of benefit in arresting the progress. When there are much heat and pain the limb should be at rest, cold compresses applied at night, the joints wrapped in oiled silk, and in the morning thoroughly massaged. It is surprising how much can be done by carefully applied friction to reduce the thickening, to promote absorption of effusion, and to restore mobility. Massage is also of special benefit in maintaining the nutrition of the muscles, which early tend to atrophy. In the case of the knees this mode of treatment will sometimes prevent the retraction of the muscles and the gradual flexion of the legs on the thighs. No benefit can be expected from electricity.

VI. GOUT (*Podagra.*)

Definition.—A nutritional disorder, associated with an excessive formation of uric acid, and characterized clinically by attacks of acute arthritis, by the gradual deposition of urate of soda in and about the joints, and by the occurrence of irregular constitutional symptoms.

Etiology.—It is now generally recognized that the disease depends upon disturbed metabolism; most probably upon defective oxidation of nitrogenous food-stuffs.

Among important etiological factors in gout are the following:

(*a*) *Hereditary Influences.*—Statistics show that in from fifty to sixty per cent of all cases the disease existed in the parents or grandparents. The transmission is supposed to be more marked from the male side. Cases with a strong hereditary taint have been known to develop before puberty. The disease has been seen even in infants at the breast. Males are more subject to the disease than females. It rarely develops before the thirtieth year; and in a large majority of the cases the first manifestations appear before the age of fifty. (*b*) *Alcohol* is the most potent factor in the etiology of the disease. Fermented liquors favor its development much more than distilled spirits, and it prevails most extensively in countries like England and Germany, which consume the most beer and ale. Probably the greater tendency of malt liquors to induce gout is associated with the production of an acid dyspepsia. The lighter beers used in this country are much less liable to produce gout than the heavier English and Scotch ales. (*c*) *Food* plays a *rôle* equal in importance to that of alcohol. From the time of Hippocrates overeating has been regarded as a special predisposing cause. The excessive use of food, particularly of meats, disturbs gastric digestion and leads to the formation of lactic and volatile fatty acids. It is held by Garrod and others that these tend to decrease the alkalinity of the blood and to reduce its power of holding urates in solution. A special form of gouty dyspepsia has been described. A robust and active digestion is, however, often met in gouty persons. Gout is by no means confined to the rich. In England the combination of

poor food, defective hygiene, and an excessive consumption of malt liquors makes the "poor man's gout" a common affection. (*d*) *Lead.* Garrod has shown that workers in lead are specially prone to gout. In thirty per cent of his hospital cases the patients had been painters or workers in lead. The association is probably to be sought in the production by this poison of arterio-sclerosis and chronic nephritis. Something in addition is necessary, or certainly in this country we should more frequently see cases of the kind so common in London hospitals. Chronic lead-poisoning is here frequently associated with arterio-sclerosis and contracted kidneys, but acute arthritis is rare. Gouty deposits are, however, to be found in the big-toe joint and in the kidneys in these cases.

There are three theories with reference to gout:

(1) *The Uric-acid Theory.*—Sir Alfred Garrod, to whom the profession is indebted for so many careful studies in this disease, showed that there was an increase in the uric acid in the blood, due either to increased production or to diminished elimination; and that the alkalinity of the blood was also lessened. He attributes the deposition of the urate of soda to the diminished alkalinity of the plasma, which is unable to hold it in solution. An increase in the quantity of the uric acid produced, or any interference with elimination through the kidneys, may cause a sudden outbreak. The acute paroxysm is due to an accumulation of the urates in the blood, which he believes are responsible also for the preliminary dyspepsia, the coated tongue, the irritability of temper, and the general feelings of *malaise.* The sudden deposit of the crystalline urates about the joint leads to inflammation.

(2) *The Nervous Theory.*—The view of Cullen that gout was primarily an affection of the nervous system has been modified into a neuro-humoral view which has been advocated particularly by Sir Dyce Duckworth. On this theory there is a basic, arthritic stock—a diathetic habit, of which gout and rheumatism are two distinct branches. The gouty diathesis is expressed in (*a*) a neurosis of the nerve-centres, which may be inherited or acquired; and (*b*) "a peculiar incapacity for normal elaboration within the whole body, not merely in the liver or in one or two organs, of food, whereby uric acid is formed at times in excess, or is incapable of being duly transformed into more soluble and less noxious products" (Duckworth). The explosive neuroses and the influence of depressing circumstances, physical or mental, point strongly to the part played by the nervous system in the disease.

(3) *Ebstein's Theory.*—A nutritive tissue disturbance is the primary change leading to necrosis, and in the necrotic areas the urates are deposited. This is not unlike the view of Ord, who holds that there is a tendency, inherited or acquired, to a special form of tissue degeneration.

Morbid Anatomy.—The *blood* shows an excess of uric acid, as proved originally by Garrod. The uric acid may be obtained from the

blood-serum by the method known as uric-acid thread experiment, or from the serum obtained from a blister. To ʒ ij of serum add ♏ v–vj of acetic acid in a watch-glass. A thread immersed in this will show in a few hours an incrustation of uric acid. This is not, however, peculiar to gout, but occurs in leukæmia and chlorosis. The important changes are in the articular tissues. The first joint of the great toe is most frequently involved; then the ankles, knees, and the small joints of the hands and wrists. The deposits may be in all the joints of the lower limbs and absent from those of the upper limbs (Norman Moore). If death takes place during an acute paroxysm, there are signs of inflammation, hyperæmia, swelling of the ligamentous tissues, and of effusion into the joint. The primary change, according to Ebstein, is a local necrosis, due to the presence of an excess of urates in the blood. This is seen in the cartilage and other articular tissues in which the nutritional currents are slow. In these areas of coagulation necrosis the reaction is always acid and the neutral urates are deposited in crystalline form, as insoluble acid urates. The articular cartilages are first involved. The gouty deposit may be uniform, or in small areas. Though it looks superficial, the deposit is invariably interstitial and covered by a thin lamina of cartilage. The deposit is thickest at the part most distant from the circulation. The ligaments and fibro-cartilage ultimately become involved and are infiltrated with chalky deposits, the so-called chalk-stones, or tophi. These are usually covered by skin; but in some cases, particularly in the metacarpophalangeal articulations, this ulcerates and the chalk-stones appear externally. The synovial fluid may also contain crystals. In very long-standing cases, owing to an excessive deposit, the joint becomes immobile. The marginal outgrowths in gouty arthritis are true exostoses (Wynne). The cartilage of the ear may contain tophi, which are seen as yellowish nodules at the margin of the helix. The cartilages of the nose, eyelids, and larynx are less frequently affected.

Of changes in the internal organs, those in the renal and vascular systems are the most important. The kidney changes believed to be characteristic of gout are: (*a*) A deposit of urates chiefly in the region of the papillæ. This is a less common change, however, than is usually supposed. Norman Moore found it in only twelve out of eighty cases. The apices of the pyramids show lines of whitish deposit. On microscopical examination the material is seen to be largely in the intertubular tissue. In some instances, however, the deposit seems to be both in the tissue and in the tubules. Ebstein, in his monograph, has described and figured areas of necrosis in both cortex and medulla, in the interior of which were crystalline deposits of urate of soda. The presence of these uratic concretions at the apices of the pyramids is not a positive indication of gout. They are not infrequent in this country, in which gout is rare. (*b*) An interstitial nephritis, either the ordinary "contracted kidney" or the arterio-sclerotic form, neither of which are in any way distinctive. It is

not possible to say in a given case that the condition has been due to gout unless marked evidences of the disease coexist.

The metatarso-phalangeal joint of the big toe should be carefully examined, as it may show typical lesions of gout without any outward token of arthritis.

Arterio-sclerosis is a very constant lesion. With it the heart, particularly the left ventricle, is found hypertrophied. According to some authors, concretions of urate of soda may occur on the valves.

Changes in the respiratory system are rare. Deposits have been found in the vocal cords, and uric-acid crystals have been met in the sputa of a gouty patient (J. W. Moore). Emphysema is a very constant condition in old cases.

Symptoms.—Gout is usually divided into acute, chronic, and irregular forms.

Acute Gout.—Premonitory symptoms are common—twinges of pain in the small joints of the hands or feet, nocturnal restlessness, irritability of temper, and dyspepsia. The urine is acid, scanty, and high-colored. It deposits urates on cooling, and there may be, according to Garrod, transient albuminuria. There may be traces of sugar (gouty glycosuria). Before an attack the output of uric acid is low and is also diminished in the early part of the paroxysm. In some instances the throat is sore, and there may be asthmatic attacks. The attack sets in usually in the early morning hours. The patient is aroused by a severe pain in the metatarso-phalangeal articulation of the big toe, and more commonly on the right than on the left side. The pain is agonizing, the joint swells rapidly, and becomes hot, tense, and shiny. The sensitiveness is extreme, and the patient describes the pain as if the joint were being pressed in a vice. There is fever, and the temperature may rise to 102° or 103°. Toward morning the severity of the symptoms subsides, and, although the joint remains swollen, the day may be passed in comparative comfort. The symptoms recur the next night, and the fit, as it is called, usually lasts for from five to eight days, the severity of the symptoms gradually abating. Occasionally other joints are involved, particularly the big toe of the opposite foot. The inflammation, however intense, never goes on to suppuration. With the subsidence of the swelling the skin desquamates. After the attack the general health may be much improved. Recurrences are frequent. Some patients have three or four attacks in a year; others at longer intervals. Lecorché has shown that the amount of uric acid is reduced prior to an attack, diminishes during the first two days, then increases very much and falls toward the close.

The term *retrocedent* or *suppressed* gout is applied to serious internal symptoms, coincident with a rapid disappearance or improvement of the local signs. Very remarkable manifestations may occur under these circumstances. The patient may have severe gastro-intestinal symptoms—pain, vomiting, diarrhœa, and great depression—and death may occur

Persons with chronic gouty arthritis and tophi are liable to intercurrent acute attacks of polyarthritis in which the joints become red and inflammed. Even with very little fever the condition may be dangerous on account of the liability to serious disturbance of the kidneys with the production of uraemia and of the development of intercurrent involvement of the serous membranes or of the meninges.

during such an attack. Or there may be cardiac manifestations—dyspnœa, pain, and irregular action of the heart. In some instances in which the gout is said to attack the heart, an acute pericarditis develops and proves fatal. So, too, there may be marked cerebral manifestations—delirium and coma, and even apoplexy—but in a majority of these instances the symptoms are, in all probability, uræmic.

Acute gout is a rare disease in America, and in hospital practice is almost unknown. Among the well-to-do and even among club-men—a class particularly liable—it is infrequent, in comparison with the prevalence in the corresponding classes in England. Men in large family practice may pass a year or more without seeing a case. It has become more common, however, during the past twenty-five years.

Chronic Gout.—With increased frequency in the attacks, the articular symptoms persist for a longer time, and gradually many joints become affected. Deposits of urates take place, at first in the articular cartilages and then in the ligaments and capsular tissues; so that in the course of years the joints become swollen, irregular, and deformed. The feet are usually first affected, then the hands. In severe cases there may be extensive concretions about the elbows and knees and along the tendons and in the bursæ. The tophi appear in the ears. Finally, a unique clinical picture is produced which cannot be mistaken for any other affection. The skin over the tophi may rupture or ulcerate, and about the knuckles the chalk-stones may be freely exposed. Patients with chronic gout are usually dyspeptic, often of a sallow complexion, and show signs of arteriosclerosis. The pulse tension is increased, the vessels are stiff, and the left ventricle is hypertrophied. The urine is increased in amount, is of low specific gravity, and usually contains a slight amount of albumen, with a few hyaline casts. Patients with chronic gout may show remarkable mental and even bodily vigor. Certain of the most distinguished members of our profession have been terrible sufferers from this disease—notably the elder Scaliger, Jerome Cardan, and Sydenham, whose statement that "more wise men than fools are victims of the affection" still holds good.

Irregular Gout.—This is a motley, ill-defined group of symptoms, manifestations of a condition of disordered nutrition, to which the terms *gouty diathesis* or *lithæmic state* have been given. Cases are seen in members of gouty families, who may never themselves have suffered from the acute disease, and in persons who have lived not wisely but too well, who have eaten and drunk largely, lived sedentary lives, and yet have been fortunate enough to escape an acute attack. It is interesting to note the various manifestations of the disease in a family with marked hereditary disposition. The daughters often escape, while one son may have gouty attacks of great severity, even though he lives a temperate life and tries in every way to avoid the conditions favoring the disorder. Another son has, perhaps, only the irregular manifestations and never the acute articu-

lar affection. While the irregular features are perhaps more often met with in the hereditary affection, they are by no means infrequent in persons who appear to have acquired the disease. The tendency in some families is to call every affection gouty. Even infantile complaints, such as scald-head, naso-pharyngeal vegetations, and enuresis, are often regarded, without sufficient grounds, I believe, as evidences of the family ailment. Among the commonest manifestations of irregular gout are the following:

(*a*) *Cutaneous Eruptions.*—Garrod and others have called special attention to the frequent association of eczema with the gouty habit. The French in particular insist upon the special liability of gouty persons to skin affections, the *arthritides*, as they call them.

(*b*) *Gastro-intestinal Disorders.*—Attacks of what is termed biliousness, in which the tongue is furred, the breath foul, the bowels constipated, and the action of the liver torpid, are not uncommon in gouty persons.

(*c*) *Cardio-vascular Symptoms.*—With the lithæmia, arterio-sclerosis is frequently associated. The blood tension is persistently high, the vessel walls become stiff, and cardiac and renal changes gradually develop. In this condition the manifestations may be renal, as when the albuminuria becomes more marked, or dropsical symptoms supervene. The manifestations may be cardiac, when the hypertrophy of the left ventricle fails and there are palpitation, irregular action, and ultimately a condition of asystole. Or, finally, the manifestations may be vascular, and involvement of the coronary arteries may cause sudden death. Aneurism may develop and prove fatal, or, as most frequently happens, a blood-vessel gives way in the brain, and the patient dies of apoplexy. It makes but little difference whether we regard this condition as primarily an arterio-sclerosis or as a gouty nephritis; the point to be remembered is that the nutritional disorder with which an excess of uric acid is associated induces in time increased tension, arterio-sclerosis, chronic interstitial nephritis, and changes in the myocardium. Pericarditis is not infrequent in connection with the granular kidney met with in gout.

(*d*) *Cerebral Manifestations.*—Headache is frequent. Haig has called special attention to the association of this symptom with retention of uric acid in the system. Neuralgias are not uncommon; sciatica and paræsthesias may develop. A common gouty manifestation, upon which Duckworth has laid stress, is the occurrence of hot or itching feet at night. Cramps in the legs may also be very troublesome. Hutchinson has called attention to hot and itching eyeballs as a frequent sign of masked gout. More serious cerebral manifestations result from a condition of arterio-sclerosis. Apoplexy is a common termination of gout. A low meningitis may develop, usually basilar.

(*e*) *Urinary Disorders.*—The urine is highly acid and high-colored, and may deposit on standing crystals of lithic acid. Transient and tem-

Itching anus (Dr Ewart.) often affd. always definite

a gouty parotitis is described

thrombosis

~~Plutarch spoke of~~ Strabo spoke of this symptom as the "lisping yoke gout" (Plutarch)

porary increase in this ingredient cannot be regarded as serious. In many cases of chronic gout the amount may be diminished, and only increased at certain periods, forming the so-called uric-acid showers. Sugar is found intermittently in the urine of gouty persons—gouty glycosuria. It may pass into true diabetes, but is usually very amenable to treatment. Oxaluria may also be present Gouty persons are specially prone to calculi, Jerome Cardan to the contrary, who reckoned freedom from stone among the chief of the *dona podagræ*. Minute quantities of albumen are very common in persons of gouty dyscrasia, and, when the renal changes are well established, tube-casts. Urethritis, accompanied with a well-marked purulent discharge, may develop, so it is stated, usually at the end of an attack. It may occur spontaneously, or follow a pure connection.

(*f*) *Pulmonary Disorders.*—There are no characteristic changes, but, as Greenhow has pointed out, chronic bronchitis occurs with great frequency in persons of a gouty habit.

(*g*) Of eye affections, iritis, glaucoma, hæmorrhagic retinitis, and suppurative panopthalmitis have been described.

Treatment.—Individuals who have inherited a tendency to gout, or who have shown any manifestations of it, should live temperately, abstain from alcohol, and eat moderately. An open-air life, with plenty of exercise and regular hours, does much to counteract an inborn tendency to the disease.

Diet.—Experience has shown that a modified nitrogenous diet is the most suitable. Starchy and saccharine articles of food are to be taken in very limited quantities; as "the conversion of azotized food is more complete with a minimum of carbohydrates than it is with an excess of them —in other words, one of the best means of avoiding the accumulation of lithic acid in the blood is to diminish the carbohydrates rather than the azotized foods" (Draper). Meats of all kinds, except perhaps the coarser sorts, such as pork and veal, and salted provisions, may be used. Eggs, oysters, and fish may be taken. Lobsters and crabs, particularly when made into salads, are to be eschewed. The sugar should be reduced to a minimum. The sweeter fruits should not be taken. Oranges and lemons may be allowed. Strawberries, bananas, and melons should not be eaten. If necessary, saccharin may be substituted for cane sugar. Potatoes should be sparingly used. The fresh vegetables, such as lettuce, cucumbers, tomatoes, and cauliflower, may be taken freely. Hot rolls and cakes of all sorts, hominy, grits, and the more starchy forms of prepared foods are not suitable. The various articles of diet prepared from corn should be avoided. Fats are easily digested and may be taken freely. In obstinate cases great benefit is derived from an exclusively milk diet.

Persons with a gouty tendency should be encouraged to drink freely of such mineral waters as they prefer. They keep the interstitial circulation active and so favor elimination. Milk and potash-water form a pleasant and wholesome drink for a lithæmic patient. Alcohol in all forms

should be avoided. When from any cause a stimulant is indicated, claret, dry sherry, or good whisky is preferable. Champagne is particularly pernicious. Persons with a marked tendency to lithæmia should be urged to restrict the appetite and to take only a moderate amount of food. Overeating is not far behind excessive drinking in its injurious effects. Indeed, a majority of people over forty years of age take more food than is required to maintain the equilibrium of health. Gout, in many cases, is evidence of an overfed, overworked, and consequently clogged machine.

The skin should be kept active: if the patient is robust, by the morning cold bath with friction after it; but if weak or debilitated, the evening warm bath should be substituted. An occasional Turkish bath with active shampooing is advantageous. The secretion of urine should be fully maintained, and the specific gravity reduced by diluents to at least 1·015. The bowels should be kept open and an occasional saline purgative may be administered. The patient should dress warmly, avoid rapid alterations in temperature, and be careful not to have the skin suddenly chilled. Gouty persons derive much benefit from taking certain waters, such as Saratoga, the Bedford, the White Sulphur of Virginia, in this country; the Bath and Harrogate, in England; and those of Carlsbad, Kissingen, Homburg, Vichy, and Contrexéville, on the continent.

In an acute attack the limb should be elevated and the affected joint wrapped in cotton-wool. Warm fomentations, or Fuller's lotion, may be used. Steaming the joint is sometimes beneficial. A brisk mercurial purge is always advantageous at the outset. The wine or tincture of colchicum, in doses of twenty to thirty minims, may be given every four hours in combination with the citrate of potash or the citrate of lithium. The colchicum should be carefully watched. It has, in a majority of the cases, a powerful influence over the symptoms; relieving the pain and reducing, sometimes with great rapidity, the swelling and redness. It should be promptly stopped as soon as it has relieved the pain. In cases in which the pain and sleeplessness are more distressing and do not yield to colchicum, morphia may be necessary. The patient should be placed on a low diet, chiefly of milk and barley-water, but if there is any debility, strong broths may be given, or eggs. It is occasionally necessary to give small quantities of stimulants. Potash water, Apollinaris, or Seltzer water should be taken freely. Waters with the sodium salts should be avoided. During convalescence meats and fish and game may be taken, and gradually the patient may resume the diet previously laid down.

In the chronic and irregular forms of gout the treatment by hygiene and diet is most suitable. Colchicum is not often required, though in small doses it is sometimes beneficial. Lithium salts do good, since a combination of uric acid with lithium is more soluble than the sodium salt. There is no good native lithia water. The medicine is best given

in potash water, in a glassful of which five grains of the citrate of lithium may be taken three times a day, or the *liquor lithiæ effervescens* of the British Pharmacopœia may be used. The mineral waters above mentioned are particularly beneficial, partly in themselves, and partly owing to the strict regulations to which the patient is subjected when taking the "cure." Ammoniacum, guaiacum, and preparations of quinine and iron are sometimes serviceable in the chronic gout. Iodide of potassium and the benzoates are also recommended. The local treatment of joints affected with chronic gout is not satisfactory. Hydrotherapeutic measures, the Paquelin, and massage may be tried.

VII. DIABETES MELLITUS.

Definition.—A disorder of nutrition, in which sugar accumulates in the blood and is excreted in the urine, the daily amount of which is greatly increased.

Etiology.—Hereditary influences play an important *rôle*, and cases are on record of its occurrence in many members of the same family. There are instances of the coexistence of the disease in husband and wife. Men are more frequently affected than women. It is a disease of adult life; a majority of the cases occur from the third to the sixth decade. It is rare in childhood, but cases are on record in children under one year of age. Persons of a neurotic temperament are often affected. It is a disease of the higher classes. Hebrews seem especially prone to it; one fourth of Frerichs' cases were of the Semitic race. In a considerable proportion of the cases of diabetes the subjects have been excessively fat at the beginning of, or prior to, the onset of the disease. It must be remembered, however, that a slight trace of sugar is not very uncommon in obese persons. This so-called lipogenic glycosuria is not of grave significance, and is only occasionally followed by true diabetes. There are instances on record in which obesity with diabetes has occurred in three generations. It is more common in cities than in country districts. Gout, syphilis, and malaria have been regarded as predisposing causes. Mental shock, severe nervous strain, and worry precede many cases. The combination of intense application to business, over-indulgence in food and drink, with a sedentary life, seem particularly prone to induce the disease. It may set in during pregnancy, and in rare instances may only occur at this period. Injury to or disease of the spinal cord or brain has been followed by diabetes. In the carefully analyzed cases of Frerichs there were thirty instances of organic disease of these parts. The medulla is not always involved. In only four of his cases, which showed organic disease, was there sclerosis or other anomaly of this part. An irritative lesion of Bernard's diabetic centre in the medulla is an occasional cause. I saw with Riess, at the Friedrichshain, Berlin, a woman who had anomalous

cerebral symptoms and diabetes, and in whom there was found post mortem a cysticercus in the fourth ventricle.

Of late years lesions of the pancreas have been held to cause diabetes, and in a certain number of cases this organ is affected. The disease has occasionally followed the infectious fevers. A few cases have followed injury without involvement of the brain or cord.

In comparison with European countries diabetes is a rare disease in America. The last census gave only 2·8 per one hundred thousand of population, against a ratio of from five to nine in the former. In this region the incidence of the disease may be gathered from the fact that among thirty-five thousand patients under treatment at the Johns Hopkins Hospital and Dispensary there were only ten cases.

We are ignorant of the nature of the disease. Normally the carbohydrates taken with the food are stored in the liver as glycogen, and then utilized as needed by the system. Glycogen can also be formed from the proteids of the food, and under certain circumstances sugar may be directly formed from the body proteids. Whenever the sugar in the systemic blood exceeds a definite amount it is discharged by the kidneys, producing glycosuria. Theoretically the condition may be supposed to be induced by:

(*a*) The ingestion of a larger quantity of carbohydrates and peptones than can be warehoused, so to speak, in the liver as glycogen, so that part has to pass over into the hepatic blood. Some of the instances of lipogenic or dietetic glycosuria are of this nature.

(*b*) Disturbances of the liver function: (1) Changes in the circulation under nervous influences. Puncture of the medulla, lesions of the cord, and central irritation of various kinds are followed by glycosuria, which is attributed to a vaso-motor paralysis (more rapid blood-flow) induced by these causes. On this view the disease is a neurosis. (2) Instability of the glycogen, owing either to imperfect formation or to conditions of the cells which render it less stable. Phloridzin and other substances which cause diabetes very probably act in this way.

(*c*) Defective assimilation of the glucose in the system. How and under what normal circumstances the sugar is utilized we do not yet know. Theoretically faulty metabolism would explain the condition.

Interesting observations have of late made it probable that the pancreas may in some cases be the seat of the trouble. Lesions of this organ have frequently been met with in diabetes. Von Mering and Minkowski have shown that extirpation of the gland in dogs is followed by glycosuria, but, if a small portion remains, sugar does not appear in the urine, facts which have been confirmed by Lepine and others. The pancreas, on this view, has, like the liver, a double secretion—an external, which is poured into the intestines, and an internal, which passes into the blood. This latter is supposed to be of the nature of a ferment, in the presence of which alone the normal assimilative processes can take place with the glycogen. Disease of the pancreas causes diabetes by preventing the formation of

8

Davis.

and in the muscles.

(about 0.2 per cent)

diabetes

though phloridzin is said to act primarily in the renal epithelium, destroying its power of keeping back the sugar.

are met with in about 5·0 per cent of the cases (Hasenmann)

Here may be given the conclusions of von Noorden ~~can only here be given~~ [illegible] The student is referred for the best modern discussion of the whole question to the exhaustive article (Twentieth century Practice Vol. iii) [illegible]

(p 60

R. T. Williamson has found changes in the posterior columns of the cord similar to those which occur in pernicious anaemia

~~may be~~ it's hypertrophied in some cases

arterio-sclerosis is common

Hansemann* in forty cases of pancreatic disease with diabetes found simple atrophy in thirty six and he gives a table of seventy two cases from the literature

* Ziebsch. f. Klin. Med. Bd. XXVI

the glycolytic ferment. Even when, as in a majority of instances of diabetes, the organ is apparently normal, a functional trouble may disturb the formation of this ferment. The fact that if a small portion of the gland is left, in the experiments upon dogs, diabetes does not occur, is analogous to the remarkable circumstance that a small fragment of the thyroid is sufficient to prevent the development of artificial myxœdema. It has recently been stated by Falkenberg that extirpation of the thyroid gland in dogs is also followed by diabetes.

Morbid Anatomy.—Saundby * has recently analyzed the changes which occur in this disease.

The *nervous system* shows no constant lesions. In a few instances there have been tumors or sclerosis in the medulla, or, as in the case above mentioned, a cysticercus has pressed on the floor. Cysts have been met with in the white matter of the cerebrum and perivascular changes have been described. Glycogen has been found in the spinal cord. In the peripheral nervous system there are instances in which tumors have been found pressing on the vagus. A secondary multiple neuritis is not rare, and to it the so-called diabetic tabes is probably due.

In the sympathetic system the ganglia have been enlarged and in some instances sclerosed, but there is nothing peculiar in these changes. The *blood* may contain as high as 0·4 per cent of sugar instead of 0·15 per cent. The plasma is usually loaded with fat, the molecules of which may be seen as fine particles. When drawn, a white creamy layer coats the coagulum, and there may be lipæmic clots in the small vessels. There are no special changes in the red or white corpuscles. Gabritschewsky has shown that the "polynuclear" leucocytes in diabetes contain glycogen. Glycogen can occur in normal blood, but it is here extra-cellular. It has been also found in the polynuclear leucocytes in leukæmia. The *heart* shows no characteristic changes. Endocarditis is very rare. The *lungs* show important changes. Acute broncho-pneumonia or croupous pneumonia (either of which may terminate in gangrene) and tuberculosis are common. The so-called diabetic phthisis is always tuberculous and results from a caseating broncho-pneumonia. In rare cases there is a chronic interstitial pneumonia, non-tuberculous. Fatty embolism of the pulmonary vessels has been described in connection with diabetic coma.

The *liver* is usually enlarged, fatty degeneration is common, and French writers have described a form of cirrhosis. Letulle, who has described remarkable examples of this so-called diabetic cirrhosis—the *cirrhose pigmentaire*—thinks the change is due to abnormal destruction of the blood-cells. It may be associated with bronzing of the skin.

The *pancreas*, as pointed out by Lancereaux, shows important changes. Saundby states that in seven out of fifteen cases it was atrophied, abnor-

* Bradshaw Lecture, Royal College of Physicians of London, 1890; and Lectures on Diabetes, E. B. Treat, New York, 1891.

mally firm and fibroid in four, and normal in only four. A patient of W. T. Bull died of diabetes after extirpation of the pancreas. In some instances there is a pigmentary cirrhosis analogous to that which occurs in the liver, and this induration seems to be an important change. Cancer of the pancreas has been met with, and Longstreth found, in one instance, cystic disease. Fat necrosis of the pancreas has also been found. Neither the *stomach* nor the *intestines* show any characteristic lesions.

The *kidneys* are sometimes fatty, and show a hyaline change in the tubular epithelium, particularly of the descending limb of the loop of Henle. It also occurs in the capillary vessels. Saundby confirms the occurrence of this hyaline change, and its restriction to the epithelium of Henle's tubes.

Symptoms.—*Acute* and *chronic* forms are recognized, but there is no essential difference between them, except that in the former the patients are younger, the course more rapid, and the emaciation more marked.

It is also possible to divide the cases into (1) *lipogenic* or *dietetic*, which includes the transient glycosuria of stout persons; (2) *neurotic*, due to injuries or functional disorders of the nervous system; and (3) *pancreatic*, in which there is a lesion of the pancreas. It is, however, by no means easy to discriminate in all cases between these forms. Of late attempts have been made to separate a clinical variety analogous to experimental pancreatic diabetes. Hirschfeld, from Guttmann's clinic, has described cases running a rapid and severe course usually in young and middle-aged persons. The polyuria is less common or even absent, and there is a striking defect in the assimilation of the albuminoids and fats, as shown by the examination of the fæces and urine. In four of seven cases autopsies were made and the pancreas was found atrophic in two, cancerous in one, and in the fourth exceedingly soft.

The *onset* of the disease is gradual and either frequent micturition or inordinate thirst first attracts attention. Very rarely it sets in rapidly, after a sudden emotion, an injury, or after a severe chill. When fully established the disease is characterized by great thirst, the passage of large quantities of saccharine urine, a voracious appetite, and, as a rule, progressive emaciation.

The Urine.—The amount varies from six or eight pints in mild cases to thirty or forty pints in very severe cases. In rare instances the quantity of urine is not much increased. Under strict diet the amount is much lessened, and in intercurrent febrile affections it may be reduced to normal. The specific gravity is high, ranging from 1·025 to 1·045. The urine is pale in color, almost like water, and has a sweetish odor and a distinctly sweetish taste. The reaction is acid. Sugar is present in varying amounts. In mild cases it does not exceed one and a half or two per cent, but it may reach from five to ten per cent. The total amount excreted in the twenty-four hours may range from ten to twenty ounces, and in

and calculi.

Dilatation of the stomach is common.

Shows usually a diffuse nephritis with fatty change & degeneration

in exceptional cases it
but may be low 1003 to 1020

Pneumaturia, the formation of gas in the upper bladder, is occasionally met with due to fermentative processes in the bladder, is occasionally met with

Lipuria may be passed in the urine in the form of fine emulsion (Lipuria)

exceptional cases from one to two pounds. The following are the most satisfactory tests:

Fehling's Test.—The solution consists of sulphate of copper (grs. 90½), neutral tartrate of potash (grs. 364), solution of caustic soda (fl. ozs. 4), and distilled water to make up six ounces. Put a drachm of this in a test-tube and boil (to test the reagent); add an equal quantity of urine and boil again, when, if sugar is present, the yellow suboxide of copper is thrown down. The solution must be freshly prepared, as it is apt to decompose.

Trommer's Test.—To a drachm of urine in a test-tube add a few drops of a dilute sulphate-of-copper solution and then as much *liquor potassæ* as urine. On boiling, the copper is reduced if sugar be present, forming the yellow or orange-red suboxide. There are certain fallacies in the copper tests. Thus, a substance called glycuronic acid is met with in the urine after the use of certain drugs—chloral, phenacetin, morphia, chloroform, etc.—which reduces copper. It has been found in the urine of an apparently healthy man (Ashdown).

Fermentation Test.—This is free from all doubt. Place a small fragment of yeast in a test-tube full of urine, which is then inverted over a glass vessel containing the same fluid. If sugar is present, fermentation goes on with the formation of carbon dioxide, which accumulates in the upper part of the tube and gradually expels the urine.*

Of other ingredients in the urine, the urea is increased, the uric acid does not show special changes, and the phosphates may be greatly in excess. Ralfe has described a great increase in the phosphates, and in some of these cases, with an excessive excretion, the symptoms may be very similar to those of diabetes, though the sugar may not be constantly present. The term phosphatic diabetes has sometimes been applied to them. *Acetone* and acetone-forming substances are not infrequently present. Le Nobel's test for acetone is as follows: "Pour an ounce of urine into a urine glass; add a drachm or two of nitro-prusside of sodium (five grains to one ounce) and a few drops of strong liquid ammonia. After standing a few minutes a rose-violet color is developed, which, if much acetone is present, may require diluting with water in order to bring out the brilliancy of its color" (Saundby).

Glycogen has also been described as present in the urine.

Albumin is not infrequent. It occurred in nearly thirty-seven per cent of the examinations made by Lippman at Carlsbad.

Among the *general symptoms* of the disease, *thirst* is one of the most distressing. A very large amount of water is required to keep the sugar in solution and for its excretion in the urine. The amount of water consumed will be found to bear a definite ratio to the quantity excreted. Instances, however, are not uncommon of pronounced diabetes in which the

* For quantitative and other tests the student is referred to Tyson, On the Urine, or the standard works on urinalysis.

thirst is not excessive; but in such cases the amount of urine passed is never large. The thirst is most intense an hour or two after meals. As a rule, the digestion is good and the appetite inordinate. A story is told of a man with diabetes who was paid to stay away from a certain restaurant at which dinners were given at fixed prices. It is sometimes impossible to satiate the ravenous appetite of a diabetic patient. The condition is sometimes termed *bulimia* or *polyphagia*.

The tongue is usually dry, red, and glazed, and the saliva scanty. The gums may become swollen, and in the later stages aphthous stomatitis is common. Constipation is the rule.

In spite of the enormous amount of food consumed a patient may become rapidly emaciated. This loss of flesh bears some ratio to the polyuria, and when, under suitable diet, the sugar is reduced, the patient may quickly gain in flesh. The skin is dry and harsh, and perspirations rarely occur, except when phthisis coexists. Drenching sweats have been known to alternate with excessive polyuria. The temperature is often subnormal; the pulse is usually frequent, and the tension increased. Many diabetics, however, do not show marked emaciation. Patients past the middle period of life may have the disease for years without much disturbance of the health, and may remain well nourished. These are the cases of the *diabète gras* in contradistinction to *diabète maigre*.

Diabetes in Children.—Recently Stern has analyzed 117 cases in children. They usually occur among the better classes. Six were under one year of age. Hereditary influences were marked. The course of the disease is, as a rule, much more rapid than in adults. The shortest duration was two days. In seven cases it did not last a month. One case is mentioned of a child apparently born with the glycosuria, who recovered in eight months.

Complications.—(*a*) **Cutaneous.**—Boils and carbuncles are extremely common. Eczema is also met with and at times an intolerable itching. In women the irritation of the urine may cause the most intense pruritus pudendi, and in men a balanitis. Rarer affections are xanthoma and purpura. Gangrene is not uncommon. William Hunt has analyzed 64 cases. In 50 the localities were as follows: Feet and legs, 37; thigh and buttock, 2; nucha, 2; external genitals, 1; lungs, 3; fingers, 3; back, 1; eyes, 1. Perforating ulcer of the foot may occur.

(*b*) **Pulmonary.**—The patients are not infrequently carried off by *acute pneumonia*, which may be lobar or lobular. *Gangrene* is very apt to supervene, but the breath does not necessarily have the foul odor of ordinary gangrene.

Tuberculous broncho-pneumonia is very common. It was formerly thought, from its rapid course and the limitation of the disease to the lung, that this was not a true tuberculous affection; but in the cases which have come under my notice bacilli have been present, and the condition is now generally regarded as tuberculous.

(*c*) **Renal.**—*Albuminuria* is a tolerably frequent complication. The amount varies greatly, and, when slight, does not seem to be of much moment. It is sometimes associated with arterio-sclerosis. It occasionally precedes the development of the diabetic coma. Occasionally cystitis develops.

(*d*) **Nervous System.**—(1) *Diabetic coma*, first studied by Küssmaul, is the most serious complication of the disease, and carries off a considerable proportion of all cases, particularly in the young. It may occur when diabetes is unsuspected, as in two cases recently reported by Francis Minot. Frerichs recognized three groups of cases: (α) Those in which after exertion the patients were suddenly attacked with weakness, syncope, somnolence, and gradually deepening unconsciousness; death occurring in a few hours. (β) Cases with preliminary gastric disturbance, such as nausea and vomiting, or some local affection, as pharyngitis, phlegmon, or a pulmonary complication. In such cases the attack begins with headache, delirium, great distress, and dyspnœa, affecting both inspiration and expiration, a condition called by Küssmaul *air-hunger*. Cyanosis may or may not be present. If it is, the pulse becomes rapid and weak and the patient gradually sinks into coma; the attack lasting from one to five days. There may be a very heavy, sweetish odor of the breath, due to the presence of acetone. (γ) Cases in which, without any previous dyspnœa or distress, the patient is attacked with headache and a feeling of intoxication, and rapidly falls into a deep and fatal coma.

There has been much dispute as to the nature of these symptoms, but our knowledge of the disease is not yet sufficiently advanced to give a rational explanation. The character of the attack and the similarity, in many instances, to uræmia would indicate that it depended upon some toxic agent in the blood. The theory most commonly held, that this material is acetone, is supported by the presence of the acetone reaction in the urine and its odor in the breath. Stadelmann believes that the condition is not acetonæmia, but that the poisonous agent is an intermediate product between the sugar and acetone, an oxy-butyric acid.

Saunders and Hamilton have described cases in which the lung capillaries were blocked with fat. They attributed the symptoms to fat embolism, but there are many cases on record in which this condition was not found, though lipæmia is by no means infrequent in diabetes.

The symptoms have been attributed to uræmia, and albuminuria frequently precedes or accompanies the attack.

(2) *Peripheral Neuritis.*—The *neuralgias*, numbness, and tingling, which are not uncommon symptoms in diabetes, are probably minor neuritic manifestations.

Diabetic Tabes (so called).—This is a peripheral neuritis, characterized by lightning pains in the legs, loss of knee-jerk—which may occur without the other symptoms—and a loss of power in the extensors of the feet. The gait is the characteristic *steppage*, as in arsenical, alcoholic, and other

forms of neuritic paralysis. Charcot states that there may be atrophy of the optic nerves.

Diabetic Paraplegia.—This is also in all probability due to neuritis. There are cases in which power has been lost in both arms and legs.

(3) *Mental Symptoms.*—The patients are often morose, and there is a strong tendency to become hypochondriacal. General paralysis has been known to develop.

(4) *Special Senses.*—Cataract is liable to occur, and may develop with rapidity in young persons. Diabetic retinitis closely resembles the albuminuric form. Hæmorrhages are common. Sudden amaurosis, similar to that which occurs in uræmia, may occur. Paralysis of the muscles of accommodation may be present; and lastly atrophy of the optic nerves. Aural symptoms may come on with great rapidity, either an otitis media, or in some instances inflammation of the mastoid cells.

(5) *Sexual Function.*—Impotence is common, and may be an early symptom.

Course.—In children the disease is rapidly progressive, and may prove fatal in a few days. It may be stated, as a general rule, that the older the patient at the time of onset the slower the course. Cases without hereditary influences are the most favorable. In stout, elderly men diabetes is a much more hopeful disease than it is in thin persons. Middle-aged patients may live for many years, and persons are met with who have had the disease for ten, twelve, or even fifteen years.

Diagnosis.—Glycosuria, which to all intents and purposes is a mild form of the disease, is to be distinguished only by its transient character. There is no other disease with which true diabetes can be confounded. It must not be forgotten that hysterical women sometimes put sugar in the urine for the purposes of deception.

Prognosis.—In true diabetes instances of cure are rare. On the other hand, the transient or intermittent glycosuria, met with in stout overfeeders, or in persons who have undergone a severe mental strain, is very amenable to treatment. Not a few of the cases of reputed cures belong to this division. Personally I have never seen *recovery* from a case of true diabetes. Temporary arrest, reduction to a minimum of the amount of sugar excreted, and prolonged periods of good health, I have frequently seen, but neither in any one of my personal friends or acquaintances who have suffered with the disease, nor in patients who have come under my care in hospital or private practice, have I known permanent and complete disappearance of the sugar, so that an ordinary diet could be taken with impunity. Cures are, however, reported. Practically, in cases under forty years of age the outlook is bad; in older persons the disease is less serious and much more amenable to treatment.

Treatment.—In families with a marked predisposition to the disease the use of starchy and saccharine articles of diet should be restricted.

The personal hygiene of a diabetic patient is of the first importance.

changes in the posterior columns of the cord have been found.

It is a good plan at the outset to determine whether a patient contains sugar or not on a diet absolutely free from carbohydrates. In mild cases the sugar disappears in the severer cases it continues to be formed from the proteids.

including crabs lobsters & oysters.

Sources of worry should be avoided, and he should lead an even, quiet life, if possible in an equable climate. Flannel or silk should be worn next to the skin, and the greatest care should be taken to promote its action. A lukewarm, or if tolerably robust, a cold bath, should be taken every day. An occasional Turkish bath is useful. Systematic, moderate exercise should be taken. When this is not feasible, massage should be given.

Diet.—Our injunctions to-day are those of Sydenham: "Let the patient eat food of easy digestion, such as veal, mutton, and the like, and abstain from all sorts of fruit and garden stuff."

The *carbohydrates* in the food should be reduced to a minimum. Under a strict hydrocarbonaceous and nitrogenous regimen all cases are benefited and some are cured. The most minute and specific instructions should be given in each case, and the dietary arranged with scrupulous care. It is of the first importance to give the patient variety in the food, otherwise the loathing of certain essential articles becomes intolerable, and too often the patient gives up in disgust or despair. It is well, perhaps, not to attempt the absolute exclusion of the carbohydrates, but to allow a small proportion of ordinary bread, or, better still, as containing less starch, potatoes. It is best gradually to enforce a rigid system, cutting off one article after another. The following is a list of articles which diabetic patients may take:

Liquids: Soups — ox-tail, turtle, bouillon, and other clear soups. Lemonade, coffee, tea, chocolate, and cocoa; these to be taken without sugar, but they may be sweetened with saccharin. Potash or soda water, and the Apollinaris, or the Saratoga Vichy, and milk in moderation, may be used.

Of animal food: Fish of all sorts, salt and fresh, butcher's meat (with the exception of liver), poultry, and game. Eggs, butter, buttermilk, curds, and cream cheese.

Of bread: Gluten and bran bread, and almond and cocoanut biscuits.

Of vegetables: Lettuce, tomatoes, spinach, chiccory, sorrel, radishes, water-cress, mustard and cress, cucumbers, celery, and endives. Pickles of various sorts.

Fruits: Lemons, oranges, and currants. Nuts are, as a rule, allowable.

Among *prohibited articles* are the following: Thick soups, liver, ~~crabs, lobsters, and oysters; though, if the livers are cut out, oysters may be used.~~

Ordinary bread of all sorts (in quantity): rye, wheaten, brown, or white. All farinaceous preparations, such as hominy, rice, tapioca, semolina, arrowroot, sago, and vermicelli.

Of vegetables: Potatoes, turnips, parsnips, squashes, vegetable marrow of all kinds, beets, corn, artichokes, and asparagus.

Of liquids: Beer, sparkling wine of all sorts, and the sweet aërated drinks.

The chief difficulty in arranging the daily *menu* of a diabetic patient is the bread, and for it various substitutes have been advised—bran bread, gluten bread, and almond biscuits. Most of these are unpalatable, and the patients weary of them rapidly. Too many of them are gross frauds, and contain a very much greater proportion of starch than represented. A friend, a distinguished physician, who has, unfortunately, had to make trial of a great many of them, writes: "That made from almond flour is usually so heavy and indigestible that it can only be used to a limited extent. Gluten flour obtained in Paris or London contains about 15 per cent of the ordinary amount of starch and can be well used. The gluten flour obtained in this country has from 35 to 45 per cent of starch, and can be used successfully in mild but not in severe forms of diabetes."

Unless a satisfactory and palatable gluten bread can be obtained, it is better to allow the patient a few ounces of ordinary bread daily. The "Soya" bread is not any better than that made from the best gluten flour. As a substitute for sugar, saccharin is very useful, and is perfectly harmless. Glycerin may also be used for this purpose.

It is well to begin the treatment by cutting off article after article until the sugar disappears from the urine. Within a month or two the patient may gradually be allowed a more liberal regimen. An exclusively milk diet, either skimmed milk, buttermilk, or kouniyss, has been recommended by Donkin and others. Certain cases seem to improve on it, but it is not, on the whole, to be recommended.

Medicinal Treatment.—This is most unsatisfactory, and no one drug appears to have a directly curative influence. Opium alone stands the test of experience as a remedy capable of limiting the progress of the disease. Diabetic patients seem to have a special tolerance for this drug. Codeia is preferred by Pavy, and has the advantage of being less constipating than morphia. A patient may begin with half a grain three times a day, which may be gradually increased to six or eight grains in the twenty-four hours. Mitchell Bruce, from a series of elaborate observations, concludes that morphia is decidedly more powerful. In a patient at the University Hospital, Philadelphia, on whom I made a large number of observations on the comparative value of these drugs, morphia appeared to be much more potent. Patients take with benefit up to five or six grains in the twenty-four hours. The expense, too, must sometimes be taken into consideration: the cost of six grains of codeia daily would be twenty-five cents, whereas the same amount of morphia would cost only ten cents. Not much effect is noticed unless the patient is on a rigid diet. When the sugar is reduced to a minimum, or is absent, the opium should be gradually withdrawn. The patients not only bear well these large doses of morphia, but they stand its gradual reduction. Potassium bromide is often a useful adjunct. The arsenite of bromine, a solution of arsenious acid with bromine in glycerin (dose, three to five minims after meals), has been very highly recommended, but it is by no means so cer-

Alcohol according to von Noorden is a most valuable adjunct in carrying out the flesh- ~~and~~ fat diet as it ~~allows a certain~~ ~~not more than~~ save the consumption of the fat.

Medicinal treatment

(glycerine extract, dried & fresh gland)

Pancreatic preparations of the pancreas have been used in the hope that they would supply the 'internal secretion' necessary to normal sugar metabolism. The success has not however been in any way comparable with the use of the thyroid & brain in Myxoedema. In the few cases in which I have used it no benefit has followed. Lépine has isolated a glycolytic ferment from the pancreas and also from malt diastase (archives de Med. & Experimentale March 1895) and has used it with some success in four cases.

(Lebuloe's)

tain as opium. Arsenic alone may be used. Antipyrin may be given in doses of ten grains three times a day, and in cases with a marked neurotic constitution is sometimes satisfactory. The salicylates, iodoform, nitroglycerin, jambul, lithium salts, strychnine, creasote, and lactic acid have been employed.

Of the complications, the *pruritis* and *eczema* are best treated by cooling lotions of boric acid or hyposulphite of soda (1 ounce; water, 1 quart).

The *coma* is an almost hopeless complication. Inhalations of oxygen have been recommended, and lately the intravenous injections of a saline solution, as practised by Hilton Fagge. The three per cent solution of the sodium bicarbonate has generally been employed. The treatment has not, however, been satisfactory. Of seventeen cases, collected by Chadbourne, in only one was it successful; in seven there was temporary improvement; and the best that can be said for it is that it may give the patient a few hours of complete consciousness. Injections should be made as soon as possible after the appearance of the coma.

VIII. DIABETES INSIPIDUS.

Definition.—A chronic affection characterized by the passage of large quantities of normal urine of low specific gravity.

The condition is to be distinguished from diuresis or polyuria, which is a frequent symptom in hysteria, in Bright's disease, and occasionally in cerebral or other affections. Willis, in 1674, first recognized the distinction between a saccharine and non-saccharine form of diabetes.

Etiology.—The disease is most common in young persons. Of the 85 cases collected by Strauss, 9 were under five years; 12 between five and ten years; 36 between ten and twenty-five years. Males are more frequently attacked than females. The affection may be congenital. A hereditary tendency has been noted in many cases, the most extraordinary of which has been reported by Weil. Of 91 members in four generations, 23 had persistent polyuria without any deterioration in health. Injury to the nervous system has been present in certain instances, and the disease has followed sunstroke, or a violent emotion, such as fright. Traumatism has occasionally been the exciting cause. The injury may have been to the head, but in other cases the lesion has been to the trunk or to the limbs. The disease has followed rapidly the copious drinking of cold water, or a drinking-bout; or has set in during the convalescence from an acute disease. Tumors of the brain and lesions of the medulla have been met with in a few instances. Cases of polyuria have been accompanied by paralysis of the sixth nerve. Maguire has seen an instance after meningitis in which paralysis of the sixth pair occurred with it. Bernard, it will be remembered, discovered a spot in the floor of the fourth ventricle

of animals which, when punctured, produced polyuria. Lesions of the organs of the abdomen may be associated with an excessive flow of urine, which, however, should not be regarded as true diabetes insipidus. Dickenson mentions its occurrence in abdominal tumors; Ralfe, in abdominal aneurism. I have noted it in several cases of tuberculous peritonitis.

The nature of the disease is unknown. It is, doubtless, of nervous origin. The most reasonable view is that it results from a vaso-motor disturbance of the renal vessels, due either to local irritation, as in a case of abdominal tumor, or to central disturbance in cases of brain-lesion, or to functional irritation of the centre in the medulla, giving rise to continuous renal congestion.

Morbid Anatomy.—There are no constant anatomical lesions. The *kidneys* have been found enlarged and congested. The *bladder* has been found hypertrophied. Dilatation of the ureters and of the pelves of the kidneys has been present. Death has not infrequently resulted from chronic pulmonary disease. Very varied lesions have been met with in the nervous system.

Symptoms.—The disease may come on rapidly, as after a fright or an injury. More commonly it develops slowly. A copious secretion of urine, with increased thirst, are the prominent features of the disease. The amount of urine in the twenty-four hours may range from twenty to forty pints, or even more. The specific gravity is low, 1·001 to 1·005; the color is extremely pale and watery. The total solid constituents may not be reduced. The amount of urea has sometimes been found in excess. Abnormal ingredients are rare. Muscle sugar, inosite, has been occasionally found. Albumen is rare. Traces of sugar have been met with. Naturally, with the passage of such enormous quantities of urine, there is a proportionate thirst, and the only inconvenience of the disease is the necessity for frequent micturition and frequent drinking. The appetite is usually good, rarely excessive as in diabetes mellitus. The patients may be well nourished and healthy-looking. The disease in many instances does not appear to interfere in any way with the general health. The perspiration is naturally slight and the skin is harsh. The amount of saliva is small and the mouth usually dry. Cases have been described in which the tolerance of alcohol has been remarkable, and patients have been known to take a couple of pints of brandy, or a dozen or more bottles of wine, in the day.

The course of the disease depends entirely upon the nature of the primary trouble. Sometimes, with organic disease, either cerebral or abdominal, the general health is much impaired; the patient becomes thin, and rapidly loses strength. In the essential or idiopathic cases, good health may be maintained for an indefinite period, and the affection has been known to persist for fifty years. Death usually results from some intercurrent affection. Spontaneous cure may take place.

Diagnosis.—A low specific gravity and the absence of sugar in the

very prevalent particularly among the colored children of the negro & of the Italian races.

In Vienna & London

urine distinguish the disease from diabetes mellitus. Hysterical polyuria may sometimes simulate it very closely. The amount of urine excreted may be enormous, and only the development of other hysterical manifestations may enable the diagnosis to be made. This condition is, however, always transitory.

In certain cases of chronic Bright's disease a very large amount of urine of low specific gravity may be passed, but the presence of albumen and of hyaline casts, and the existence of heightened arterial tension, stiff vessels, and hypertrophied left ventricle make the diagnosis easy.

Treatment.—The treatment is not satisfactory. No attempt should be made to reduce the amount of liquid. Opium is highly recommended, but is of doubtful service. The preparations of valerian may be tried; either the powdered root, beginning with five grains three times a day, and increasing until two drachms are taken in the day, or the valerianate of zinc, in fifteen-grain doses, gradually increased to thirty grains, three times a day. Ergot is recommended by DaCosta. Ergotin may be employed. Large doses are required. Antipyrin, the salicylates, arsenic, strychnine, turpentine, and the bromides have been recommended. The constant current may be used—one pole on the loins, the other on the nape of the neck.

IX. RICKETS.

Definition.—A disease of infants, characterized by impaired nutrition and alterations in the growing bones.

Glisson, the anatomist of the liver, described the disease accurately in the seventeenth century.

Etiology.—The disease exists in all parts of the world, but is particularly marked among the poor of the larger cities, who are badly housed and ill fed. It is much more common in Europe than in America. ~~In the colored race it is frequently seen.~~ It is a comparatively rare disease in Canada. In the ~~larger~~ cities of this continent it is ~~frequently seen at the clinics, but in comparison with Vienna and London the contrast is very striking. In these cities~~ from 50 to 80 per cent of all the children at the clinics present signs of rickets. Want of sunlight and impure air are important factors. A starchy diet, too much cows' milk, and the indiscriminate feeding, so common in the children of the poor, are important agents; but something is required beyond these, for children of healthy parents, who have an ample quantity of the proper food, may become rickety. It seems probable, however, that the combination of defective food and bad air plays the most important *rôle*. Prolonged lactation or suckling a child during pregnancy are accessory etiological factors.

There is no evidence that the disease is hereditary, but there is probably a form of fœtal rickets. It is doubtful, however, whether the changes met with in this are identical with the post-natal disease. In these babies,

which are generally still-born, the limbs are short, the curves of the bones are exaggerated, and at the junction of the epiphyses there is no proliferating zone of cartilage. This condition, which Parrot calls *achondroplasy*, is really more like a fœtal *cretinism*.

Rickets affects male and female children equally. It is a disease of the first and second years of life, rarely beginning before the sixth month. Jenner has described a late rickets, in which form the disease may not appear until the ninth or even until the twelfth year. It has been held that rickets is only a manifestation of congenital syphilis (Parrot), but this is certainly not correct. Syphilitic bones rarely, if ever, present the spongy tissue peculiar to rickets, and rachitic bones never show the multiple osteophytes of syphilis. It has been regarded as an effect of malaria.

Morbid Anatomy.—The bones show the most important changes, particularly the ends of the long bones and the ribs. Between the shaft and epiphyses a slight bulging is apparent, and on section the zone of proliferation, which normally is represented by two narrow bands, is greatly thickened, bluish in color, more irregular in outline, and very much softer. The width of this cushion of cartilage varies from five to fifteen millimetres. The line of ossification is also irregular and more spongy and vascular than normal. The periosteum strips off very readily from the shaft, and beneath it there may be a spongioid tissue not unlike decalcified bone. The practical outcome of these changes is a delay in, and imperfect performance of, the ossification, so that the bone has neither the natural rate of growth nor the normal firmness. In the cranium there may be large areas, particularly in the parieto-occipital region, in which the ossification is delayed, producing the so-called cranio-tabes, so that the bone yields readily to pressure with the finger. There are localized depressed spots of atrophy, which, on pressure, give the so-called "parchment crackling." Flat hyperostoses develop from the outer table, particularly on the frontal and parietal bones, and produce the characteristic broad forehead with prominent frontal eminences, a condition sometimes mistaken for hydrocephalus.

The chemical analysis of rickety bones shows a marked diminution in the calcareous salts, which may be as low as from 25 to 35 per cent.

The liver and spleen are usually enlarged, and sometimes the mesenteric glands. As Gee suggests, these conditions probably result from the general state of the health associated with rickets. It is interesting to note that Beneke describes a relative increase in the size of the arteries in rickets.

Kassowitz, who may be considered the leading authority on the anatomy of rickets, regards the hyperæmia of the periosteum, the marrow, the cartilage, and of the bone itself as the primary lesion, out of which all the others develop. This disturbs the normal development of the growing bone, and excites changes in the bone already formed. The cartilage cells in consequence proliferate, the matrix is softer, and the bone which is

see articles in Edinburgh Med Jr. for July 1893
and German monograph.
My rachitic lungs at Cincinnati were
probably of this type

formed from this unhealthy cartilage is lacking in firmness and solidity. In the bone already formed this excessive vascularity favors the normal processes of absorption, so that the relation between removal and deposition is disturbed, absorption taking place more rapidly. The new material is poor in lime salts. Kassowitz seems to have proved experimentally that hyperæmia of bone results in defective deposition of lime salts. Barlow and Bury * have given an elaborate analysis of the changes described by this author. It is interesting to note that Glisson attributed rickets to disturbed nutrition by arterial blood, and believed the changes in the long bones to be due to excessive vascularity.

Symptoms.—The disease comes on insidiously about the period of dentition, before the child begins to walk. In many cases digestive disturbances precede the appearance of the characteristic lesions, and the nutrition of the child is markedly impaired. There is usually slight fever, the child is irritable and restless, and sleeps badly. If the child has already walked, it shows a marked disinclination to do so, and seems feeble and unsteady in its gait. Sir William Jenner has called attention to three general symptoms which are present in many cases of rickets. There is first a diffuse soreness of the body, so that the child cries when an attempt is made to move it, and prefers to keep perfectly still. This tenderness is often a marked and suggestive symptom. Associated with this are slight fever and a tendency at night to throw off the bedclothes. This may be partly due to the fact that the general sensitiveness is such that even their weight may be distressing. And, third, there is such profuse sweating, particularly about the head and neck, that in the morning the pillow is found soaked with perspiration.

The tissues become soft and flabby; the skin is pale; and from a healthy, plump condition, the child becomes puny and feeble. It is in this stage of the disease that we sometimes find such a degree of disability in the muscles, particularly of the legs, that paralysis may be suspected. This so-called pseudo-paresis of rickets results in part from the flabby, weak condition of the legs and in part from the pain associated with the movements. Such cases are by no means uncommon, but they are readily distinguished from infantile paralysis. Coincident with, or following closely upon, the general symptoms the characteristic skeletal lesions are observed. Among the first of these to appear are the changes in the ribs, at the junction of the bone with the cartilage, forming the so-called rickety rosary. When the child is thin these nodules may be distinctly seen, and in any case can be easily made out by touch. They very rarely appear before the third month. They may increase in size up to the second year, and are rarely seen after the fifth year. The thorax undergoes important changes. Just outside the junction of the cartilages with the ribs there is an oblique, shallow depression extending downward and out-

* Cyclopædia of the Diseases of Children, vol. ii.

ward. A transverse curve, sometimes called Harrison's groove, passes outward from the level of the ensiform cartilage toward the axilla and may be deepened at each inspiration. It is rendered more prominent by the eversion and prominence of the costal border. The sternum projects, particularly in its lower half, forming the so-called pigeon or chicken breast. These changes in the thorax are not peculiar, however, to rickets, and are much more commonly associated with hypertrophy of the tonsils, or any trouble which interferes with the free entrance of air into the lungs. Posteriorly the spine is usually curved, the processes are prominent, and lateral curvature may be produced.

The head of a rickety child usually looks large, and the fontanelles remain open for a long time. There are areas, particularly in the parieto-occipital regions, in which ossification is imperfect; and the bone may yield to the pressure of the finger, a condition to which the term *cranio-tabes* has been given. The relation of this condition to rickets is still somewhat doubtful, as it is very often associated with syphilis—in 47 of 100 cases recently studied by George Carpenter. Coincidently with this, hyperplasia proceeds in the frontal and parietal eminences, so that these portions of the skull increase in thickness, and may form irregular bosses. In one type the skull may be large and elongated, with the top considerably flattened. In another, and perhaps more common case, the shape of the skull, when seen from above, is rectangular—the *caput quadratum*. The skull looks large in proportion to the face. The forehead is broad and square, and the frontal eminences marked. The anterior fontanelle is late in closing and may remain open until the third or fourth year. The skin is thin, the veins are perceptible, and the hair is often rubbed from the back of the skull. In contradistinction to the cranio-tabes is the condition of cranio-sclerosis, which has also been ascribed to rickets.

On placing the ear over the anterior fontanelle, or in the temporal region, a systolic murmur may frequently be heard. This condition, first described by Fisher, of Boston, was believed by him to be peculiar to rickets. While unquestionably heard with the greatest frequency in this disease, its presence and persistence in perfectly healthy infants have been amply demonstrated.* The murmur is rarely heard after the fifth year. A knowledge of the existence of this systolic brain murmur may prevent errors. A case in which it was well marked was reported as an instance of supposed gummy tumor of the brain, in which the murmur was thought to be due to pressure on the vessels at the base.

Changes occur in the bones of the face, chiefly in the maxillæ, which are reduced in size. The normal process of dentition is much disturbed; indeed, late teething is one of the marked features in rickets. The teeth which appear may be small and badly formed.

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* Osler, On the Systolic Brain Murmur of Children, Boston Medical and Surgical Journal, 1880.

In the upper limbs changes in the scapulæ are not common. The clavicle may be thickened at the sternal end, and there may be thickening near the attachment of the sterno-cleido muscle. The most noticeable changes are at the lower ends of the radius and ulna. The enlargement is at the junction-area of the shaft and epiphysis. Less evident enlargements may occur at the lower end of the humerus. In severe cases the natural shape of the bones of the arm may be much altered, having to support the weight of the child in crawling on the floor. The changes in the pelvis are of special importance, particularly in female children, as in extreme cases they lead to great deformity and narrowing of the outlet. In the legs, the lower end of the tibia first becomes enlarged; and in slight cases it may alone be affected. In the severe forms the upper end of the bone, the corresponding parts of the fibula, and the lower end of the femur become greatly thickened. If the child walks, slight bowing of the tibiæ inevitably results. In more advanced cases the tibiæ and even the femora may be arched forward. In other cases the condition of knock-knee occurs. Unquestionably the chief cause of these deformities is the weight of the body in walking, but muscular action takes part in it. The green-stick fracture is not uncommon in the soft bones of rickets.

These changes in the skeleton proceed slowly, and the general symptoms vary a good deal with their progress. The child becomes more or less emaciated, though "fat rickets" is by no means uncommon. Fever is not constant, but in actively progressing changes in the bone there is usually a slight pyrexia. The abdomen is large, due partly to flatulent distention, partly to enlargement of the liver, and in severe cases to diminution of the volume of the thorax. The spleen is often enlarged and readily palpable. The urine is stated to contain an excess of lime salts, but Jacobi and Barlow say this has not been proved. No special or peculiar changes, indeed, have as yet been described. Many rickety children show marked nervous symptoms; irritability, peevishness, and sleeplessness are constantly present. Jenner called attention to the close relationship which existed between rickets and infantile convulsions, particularly to the fits which occur after the sixth month. Tetany is by no means uncommon. It involves most frequently the arms and hands; occasionally the legs as well. Laryngismus stridulus is a common complication, and though not, as some state, invariably associated with this disease, yet it is certainly much more frequent in rickety than in other children. Severe rickets interfere seriously with the growth of a child. Extreme examples of rickety dwarfs are not uncommon. The disease known as acute rickets is in reality a manifestation of scurvy and will be described with that disease.

Prognosis.—The disease is never in itself fatal, but the condition of the child is such that it is readily carried off by intercurrent affections, particularly those of the respiratory organs. Spasm of the larynx and

convulsions occasionally cause death. In females the deformity of the pelvis is serious, as it may lead to difficulties in parturition.

Treatment.—The better the condition of the mother during pregnancy the less likelihood is there of the development of rickets in the child. Rapidly repeated pregnancies and suckling a child during pregnancy seem important factors in the production of the disease. Of the general treatment, attention to the feeding of the child is the first consideration. If the mother is unhealthy, or cannot from any cause nurse the child, a suitable wet-nurse should be provided, or the child must be artificially fed. Cows' milk, diluted according to the age of the child, should constitute the chief food. Care should be taken to examine the condition of the stools, and if curds are present the child is taking too much, or it is not sufficiently diluted. Barley-water or carefully strained and well-boiled oatmeal gruel form excellent additions to the milk.

The child should be warmly clad and should be in the fresh air and sunshine the greater part of the day. It is a "vulgar error" to suppose that delicate children cannot stand, when carefully wrapped up, an even low temperature. The child should be bathed daily in warm water. Careful friction with sweet oil is very advantageous, and, if properly performed, allays rather than aggravates the sensitiveness. Special care should be taken to prevent deformity. The child should not be allowed to walk, and for this purpose splints applied so as to extend beyond the feet are very effective. Of medicines, phosphorus has been warmly recommended by Kassowitz, and its use is also advised by Jacobi. The child may be given gr. $\frac{1}{120}$ two or three times a day, dissolved in olive oil. Cod-liver oil, in doses of from a half to one teaspoonful, is very advantageous. The syrup of the iodide of iron may be given with the oil. The digestive disturbances, together with the respiratory and nervous complications, should receive appropriate treatment.

X. SCURVY (*Scorbutus*).

Definition.—A constitutional disease characterized by great debility, with anæmia, a spongy condition of the gums, and a tendency to hæmorrhages.

Etiology.—The disease has been known from the earliest times, and has prevailed particularly in armies in the field and among sailors on long voyages.

From the early part of this century, owing largely to the efforts of Lind and to a knowledge of the conditions upon which the disease depends, scurvy has gradually disappeared from the naval service. In the mercantile marine, cases still occasionally occur, owing to neglect of proper and suitable food.

The disease develops whenever individuals have subsisted for pro-

Achondroplasy - Fetal Rickets.

longed periods upon a diet in which fresh vegetables or their substitutes are lacking.

In comparison with former times it is now a rare disease. In seaport towns sailors suffering with the disease are occasionally admitted to hospitals. In large almshouses, during the winter, cases are occasionally seen.* On several occasions in Philadelphia characteristic examples were admitted to my wards from the almshouse. Some years ago it was not very uncommon among the lumbermen in the winter camps in the Ottawa Valley. Among the Hungarian, Bohemian, and Italian miners in Pennsylvania, cases of the disease are not infrequent. This so-called land scurvy differs in no particular from the disease in sailors. An insufficient diet appears to be an essential element in the disease, and all observers are now unanimous that it is the absence of those ingredients in the food which are supplied by fresh vegetables. What these constituents are has not yet been definitely determined. Garrod holds that the defect is in the absence of the potassic salts. Others believe that the essential factor is the absence of the organic salts present in fruits and vegetables. Ralfe, who has made a very careful study of the subject, believes that the absence from the food of the malates, citrates, and lactates reduces the alkalinity of the blood, which depends upon the carbonates directly derived from these salts. This diminished alkalinity, gradually produced in the scurvy patients, is, he believes, identical with the effect which can be artificially produced in animals by feeding them with an excess of acid salts; the nutrition is impaired, there are ecchymoses, and profound alterations in the characters of the blood. The acidity of the urine is greatly reduced and the alkaline phosphates are diminished in amount.

In opposition to this chemical view it has been urged that the disease really depends upon a specific micro-organism.

Other factors play an important part in the disease, particularly physical and moral influences; overcrowding, dwelling in cold, damp quarters, and prolonged fatigue under depressing influences, as during the retreat of an army. Among prisoners, mental depression plays an important *rôle*. It is stated that epidemics of the disease have broken out in the French convict-ships *en route* to New Caledonia, even when the diet was amply sufficient. Nostalgia is sometimes an important element. It is an interesting fact that prolonged starvation in itself does not necessarily cause scurvy. Not one of the professional fasters of late years has displayed any scorbutic symptom. The disease attacks all ages, but the old are more susceptible to it. Sex has no special influence, but during the siege of Paris it was noted that the males attacked were greatly in excess of the females. Infantile scurvy will be considered in a special note.

Morbid Anatomy.—The anatomical changes are marked, though

* Henry, Philadelphia Hospital Reports, vol. i, 1890.

by no means specific, and are chiefly those associated with hæmorrhage. The blood is dark and fluid. There are no characteristic microscopical alterations. The bacteriological examination has not yielded anything very positive. Practically there are no changes in the blood, either anatomical or chemical, which can be regarded as peculiar to the disease. The skin shows the ecchymoses evident during life. There are hæmorrhages into the muscles, and occasionally about or even into the joints. Hæmorrhages occur in the internal organs, particularly on the serous membranes and in the kidneys and bladder. The gums are swollen and sometimes ulcerated, so that in advanced cases the teeth are loose, and have even fallen out. Ulcers are occasionally met with in the ileum and colon. Hæmorrhages are extremely common into the mucous membranes. The spleen is enlarged and soft. Parenchymatous changes are constant in the liver, kidneys, and heart.

Symptoms.—The disease is insidious in its onset. Early symptoms are loss in weight, progressively developing weakness, and pallor. Very soon the gums are noticed to be swollen and spongy, to bleed easily, and in extreme cases to present a fungous appearance. The teeth may become loose and even fall out. Actual necrosis of the jaw is not common. The breath is excessively foul. The tongue is swollen, but may be red and not much furred. The salivary glands are occasionally enlarged. The lesions of the gums are rarely absent. The skin becomes dry and rough, and ecchymoses soon appear, first on the legs and then on the arms and trunk. They are petechial, but may become larger, and when subcutaneous may cause distinct swellings. In severe cases, particularly in the legs, there may be effusion between the periosteum and the bone, forming irregular nodes, which, in the case of a sailor from a whaling vessel, who came under my observation, had broken down and formed foul-looking sores. The slightest bruise or injury causes hæmorrhage into the injured part. Œdema about the ankles is common. Hæmorrhages from the mucous membranes are less constant symptoms. Epistaxis is, however, frequent. Hæmoptysis and hæmatemesis are uncommon. Hæmaturia and bleeding from the bowels may be present in very severe cases.

Palpitation of the heart and feebleness and irregularity of the impulse are prominent symptoms. A hæmic murmur can usually be heard at the base. Hæmorrhagic infarction of the lungs and spleen has been described. Respiratory symptoms are not common. The appetite is impaired, and owing to the soreness of the gums the patient is unable to chew the food. Constipation is more frequent than diarrhœa. The urine is often albuminous. The changes in the composition of the urine are not constant; the specific gravity is high; the color is deeper; and the phosphates are increased. The statements with reference to the inorganic constituents are contradictory. Some say the phosphates and potash are deficient; others that they are increased.

There are mental depression, indifference, in some cases headache, and

See Mottram's discussion

See Barlow's Bradshaw Lecture B M J Nov 10 1894

in the latter stages delirium. Cases of convulsions, of hemiplegia, and of meningeal hæmorrhage have been described. Remarkable ocular symptoms are occasionally met with, such as night-blindness or day-blindness.

In advanced cases necrosis of the bones may occur, and in young persons even separation of the epiphyses. There are instances in which the cartilages have separated from the sternum. The callus of a recently repaired fracture has been known to undergo destruction. Fever is not present, except in the later stages, or when secondary inflammations in the internal organs appear. The temperature may indeed be sometimes below normal.

Scurvy in Children.—In infants and young children, fed upon improper food, a form of cachexia develops which has been regarded as acute rickets, but which Cheadle and Barlow have shown to be a form of scurvy. The most striking cases develop in infants reared on artificial food prepared with water, though the disease has occurred when these foods were prepared with milk. Rickets strongly predispose to the condition. The cases may occur in infants, or in children up to the age of ten. Barlow thus summarizes the chief features:

"(1) Predominance of lower limb affection:

"(*a*) Immobility, going on to pseudo-paralysis; (*b*) excessive tenderness; (*c*) general swelling of lower limbs; (*d*) skin shiny and tense, but seldom pitting, and not characterized by undue local heat; (*e*) on subsidence, revealing a deep thickening of the shaft; (*f*) liability to fracture near the epiphyses.

"(2) Swelling of the gums, varying from definite sponginess down to a vanishing-point of minute transient ecchymoses. These constitute the chief diagnostic differentia between infantile scurvy and rickets, properly so called. But to them must be added, as the most important diagnostic of all, (3) definite and rapid amelioration by antiscorbutic regimen." According to Gee, hæmaturia may be the only sign of scurvy in children.

Diagnosis.—No difficulty is met in the recognition of scurvy when a number of persons are affected together. In isolated cases, however, the disease is distinguished with difficulty from certain forms of purpura. The association with manifest insufficiency in diet, and the rapid amelioration with suitable food, are points by which the diagnosis can be readily settled.

Prognosis.—The outlook is good, unless the disease is far advanced and the conditions persist which lead to its development. The mortality now is rarely great. During the civil war the death-rate was sixteen per cent. Death results from gradual heart-failure, occasionally from sudden syncope. Meningeal hæmorrhage, extravasation into the serous cavities, entero-colitis, and other intercurrent affections may prove fatal.

Prophylaxis.—The regulations of the Board of Trade require that a sufficient supply of antiscorbutic articles of diet is taken on each ship; so that now, except as the result of accident, the occurrence of scurvy on

board a vessel should lead to the indictment of the captain or owners for criminal negligence. An outbreak of the disease in an almshouse is evidence of culpable neglect on the part of the managers.

Treatment.—The juice of two or three lemons daily and a varied diet, with plenty of fresh vegetables, suffice to cure all cases of scurvy, unless far advanced. When the stomach is much disordered, small quantities of scraped meat and milk should be given at short intervals, and the lemon-juice in gradually increasing quantities. A bitter tonic, or a steel and bark mixture, may be given. As the patient gains in strength, the diet may be more liberal and he may eat freely of potatoes, cabbage, water-cresses, and lettuce. The stomatitis is the symptom which causes the greatest distress. The permanganate of potash or dilute carbolic acid forms the best mouth-wash. Pencilling the swollen gums with a tolerably strong solution of nitrate of silver is very useful. The solution is better than the solid stick, as it reaches to the crevices between the granulations. The constipation which is so common is best treated with large enemata. For other conditions, such as hæmorrhages and ulcerations, suitable measures must be employed.

XI. PURPURA.

Strictly speaking this is a symptom, not a disease; but under this term are conveniently arranged a number of affections characterized by extravasations of the blood into the skin. The purpuric spots vary from one to three or four millimetres in diameter. When small and pin-point-like they are called petechiæ; when large, they are known as ecchymoses. At first bright red in color, they become darker, and gradually fade to brownish stains. They do not disappear on pressure.

It is extremely difficult to make a satisfactory classification of purpura. Perhaps as good a division as can be made is the following:

Symptomatic Purpura.—(*a*) **Infectious.**—In pyæmia, septicæmia, malignant endocarditis (particularly in the latter affection), ecchymoses may be very abundant. In typhus fever the rash is always purpuric. Measles, scarlet fever, and more particularly small-pox, have each a variety characterized by an extensive purpuric rash.

(*b*) **Toxic.**—The virus of snakes produces with great rapidity extravasation of blood; a condition which has been very carefully studied by Weir Mitchell. Certain medicines, particularly copaiba, quinine, belladonna, mercury, ergot, and the iodides occasionally, are followed by a petechial rash. Under this division, too, comes the purpura associated with jaundice.

(*c*) **Cachectic.**—Under this heading are best described the instances of purpura which develop in the constitutional disturbance of cancer, tuberculosis, Hodgkin's disease, Bright's disease, scurvy, and in the debility of

(Urticaria) Menthol may be tried - three grains
twice or three times a day - or ichthyol -
two or or three grains in cachet after
meals -

old age. In these cases the spots are usually confined to the extremities. They may be very abundant in the lower limbs and about the wrists and hands. This constitutes, probably, the commonest variety of the disease, and many examples of it can be seen in the wards of any large hospital.

(*d*) **Neurotic.**—One variety is met with in cases of organic disease. It is the so-called myelopathic purpura, which is seen occasionally in locomotor ataxia, particularly following attacks of the lightning pains and, as a rule, involving the area of the skin in which the pains have been most intense. Cases have been met with also in acute myelitis and in transverse myelitis, and occasionally in severe neuralgia. Another form is the remarkable hysterical condition in which stigmata, or bleeding points, appear upon the skin.

(*e*) **Mechanical.**—This variety is most frequently seen in venous stasis of any form, as in the paroxysms of whooping-cough and in epilepsy.

Arthritic.—This form is characterized by involvement of the joints. It is usually known, therefore, as rheumatic, though in reality the evidence upon which this view is based is not conclusive. For the present it seems more satisfactory to use the designation arthritic. Three groups of cases may be recognized :

(*a*) A mild form, often known as **Purpura simplex,** seen most commonly in children, in whom, with or without articular pain, a crop of purpuric spots appears upon the legs, less commonly upon the trunk and arms. As pointed out by Graves, this form is not infrequently associated with diarrhœa. The disease is seldom severe. There may be loss of appetite, and slight anæmia. Fever is not, as a rule, present, and the patients get well in a week or ten days. These cases are usually regarded as rheumatic, and are certainly associated, in some instances, with undoubted rheumatic manifestations; yet in a majority of the patients which I have seen the arthritis was slighter than in the ordinary rheumatism of children, and no other manifestations were present.

(*b*) **Peliosis Rheumatica** (Schönlein's Disease).—This remarkable affection is characterized by multiple arthritis, and an eruption which varies greatly in characters, sometimes *purpuric*, more commonly associated with *urticaria* or with *erythema exudativum*. The disease is most common in males between the ages of twenty and thirty. It not infrequently sets in with sore throat, a fever from 101° to 103°, and articular pains. The purpuric rash makes its appearance first on the legs or about the affected joints. It may be a simple purpura or ordinary urticarial wheals. In other instances there are nodular infiltrations, not to be distinguished from erythema nodosum. The combination of wheals and purpura, the *purpura urticans*, is very distinctive. Much more rarely vesication is met with, the so-called *pemphigoid purpura*. The amount of œdema is variable; occasionally it is excessive. In one case, which I saw in Montreal with Molson, the chin and lower lip were enormously swollen, tense, glazed, and deeply ecchymotic. The eyelids were swollen and purpuric,

while scattered over the cheeks and about the joints were numerous spots of purpura urticans. These are the cases which have been described as *febrile purpuric œdema.* The temperature range, in mild cases, is not high, but may reach 102° or 103°.

The urine is sometimes reduced in amount and may be albuminous. The joint affections are usually slight, though associated with much pain, particularly as the rash comes out. Relapses may occur and the disease may return at the same time for several years in succession.

The diagnosis of Schönlein's disease offers no difficulty. The association of multiple arthritis with purpura and urticaria is very characteristic. In a case which I saw with Musser there was endo-pericarditis, and the question at first arose whether the patient had malignant endocarditis with extensive cutaneous infarcts.

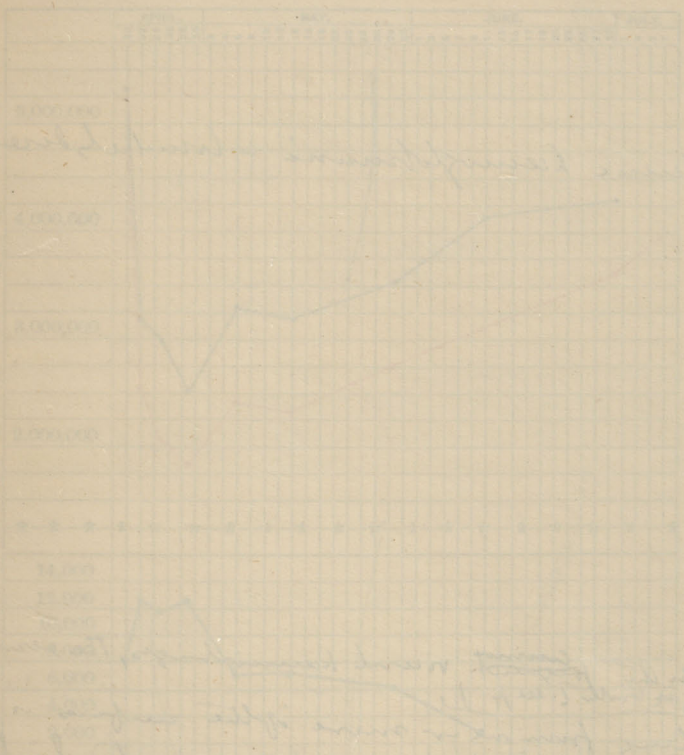
Schönlein's peliosis is thought by most writers to be of rheumatic origin, and certainly many of the cases have the characters of ordinary rheumatic fever, *plus* purpura. By many, however, it is regarded as a special affection, of which the arthritis is a manifestation analogous to that which occurs in hæmophilia. The frequency with which sore throat precedes the attack, and the occasional occurrence of endocarditis or pericarditis, are certainly very suggestive of true rheumatism.

The cases usually do well, and a fatal event is extremely rare. The throat symptoms may persist and give trouble. In two instances I have seen necrosis and sloughing of a portion of the uvula.

(*c*) There is an arthritic purpura which presents marked gastro-intestinal and renal symptoms. This not uncommon but little recognized form is met with most frequently in children and sets in usually with pains, but rarely much swelling in the joints. Purpura or purpura urticans develops about them, and the case at first looks like one of so-called rheumatic purpura. Soon other symptoms develop: the child has attacks of severe colic with vomiting and diarrhœa, true gastro-intestinal crises; which may recur with great frequency, particularly at night. There may be hæmorrhage from the bowels and soon renal symptoms. There are albumen and tube-casts, often blood, and sometimes all the symptoms of an intense hæmorrhagic nephritis. The cases may drag on for months. Death may occur from the nephritis, or from the severe gastro-intestinal disturbance. Couty, who has given the best description of this affection, regards it as a form of nervous purpura. This form has an interesting connection with the angio-neurotic œdema, which is also characterized by severe gastro-intestinal crises. Of four cases which have been under my care one died of the nephritis.*

Purpura Hæmorrhagica.—Under this heading may be considered the cases of very severe purpura with hæmorrhages from the mucous membranes. The affection, known as the *morbus maculosus* of Werlhof,

* New York Medical Journal, 1889.



The haemorrhagic diseases of the New Born.

Here may be considered:-

1 Syphilis haem

2 Epidemic haemoglobinuria - Cruveilhier's disease

(3) Apart from the ~~cutaneous~~ ~~purpura~~ ~~ecchymosis~~ at birth (see p),

3 ~~Bleeding~~ from one or more of the surfaces is not uncommon ~~event~~ in the new born; particularly in Hospital practice. Forty five cases occurred in 67 ~~00~~ deliveries (C W Townsend). The bleeding may be from the navel alone, but more commonly ~~the~~ it is general. Of Townsend's fifty cases, in 20 the blood came from the bowels (Melaena neonatorum) in 14 from the stomach in 14 from the mouth 12 from the nose. 12 from the navel 18, from the navel alone

3. The bleeding begins within the first week, but in ~~rare~~ instances is delayed to the 2nd or 3rd. Thirty one of the cases died and 19 recovered. The ~~disease~~ is usually of brief duration, death occurring in from ~~to~~ days; ~~and the cases that recovered ran from to days~~.

The temperature is often elevated. The nature of the disease is unknown. As a rule nothing abnormal is found post mortem. The general nature of the affection, its self limited character, the presence of fever, and the greater prevalence of the disease in Hospitals suggest an infectious origin. (Townsend)

The bleeding may be associated with intense haematogenous jaundice.

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is most commonly met with in young and delicate individuals, particularly in girls; but cases are described in which the disease has attacked

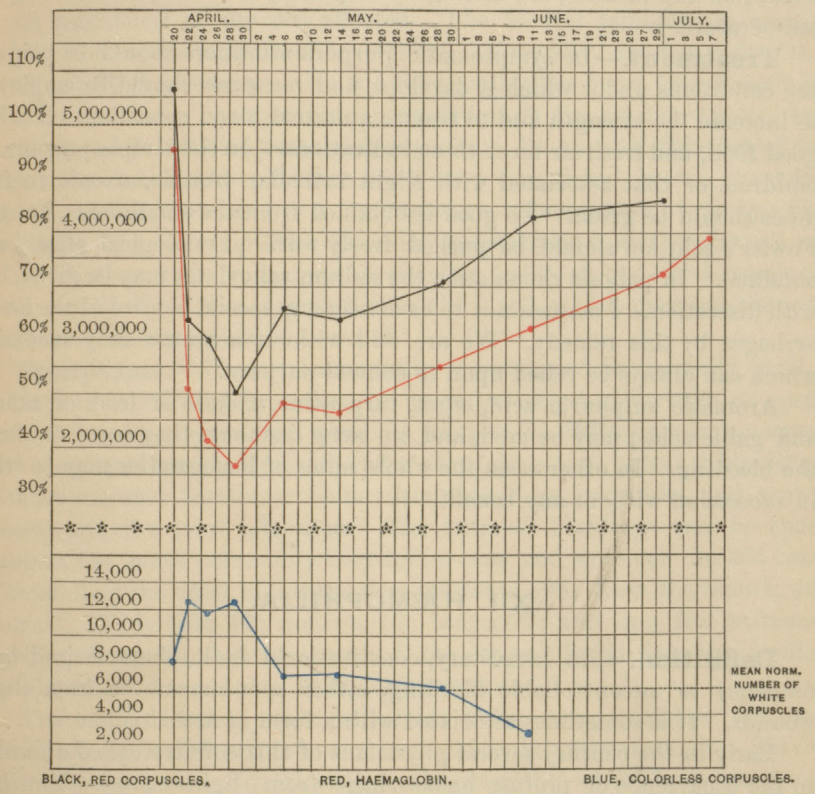


CHART XIV.—Illustrates the rapidity with which anæmia is produced in purpura hæmorrhagica and the gradual recovery.

adults in full vigor. After a few days of weakness and debility, purpuric spots appear on the skin and rapidly increase in numbers and size. Bleeding from the mucous surfaces sets in, and the epistaxis, hæmaturia, and hæmoptysis may cause profound anæmia. Chart XIV illustrates the rapidity with which anæmia is produced and the gradual recovery. Death may take place from loss of blood, or from hæmorrhage into the brain. Slight fever usually accompanies the disease. In favorable cases the affection terminates in from ten days to two weeks. There are instances of purpura hæmorrhagica of great malignancy, which may prove fatal within twenty-four hours—*purpura fulminans*. This form is most commonly met with in children, and is characterized by cutaneous hæmorrhages, which develop with great rapidity. Death may occur before any bleeding takes place from the mucous membranes.

In the *diagnosis* of purpura hæmorrhagica it is important to exclude scurvy, which may be done by the consideration of the previous health,

the circumstances under which the disease develops, and by the absence of swelling of the gums. The malignant forms of the fevers, particularly small-pox and measles, are distingished by the prodromata and the higher temperature.

Treatment.—In symptomatic purpura attention should be paid to the conditions under which it develops, and measures should be employed to increase the strength and to restore a normal blood condition. Tonics, good food, and fresh air meet these indications. In the simple purpura of children, or that associated with slight articular trouble, arsenic in full doses should be given. No good is obtained from the small doses, but the Fowler's solution should be pushed freely until physiological effects are obtained. In peliosis rheumatica the sodium salicylates may be given, but with discretion. I confess not to have seen any special control of the hæmorrhages by this remedy. We are still without a trustworthy medicine which can always be relied upon to control purpura.

Aromatic sulphuric acid, ergot, turpentine, acetate of lead, or tannic and gallic acids, may be used, and in some instances they seem to check the bleeding. In other cases the whole series of hæmostatics may be tried in succession without any benefit.

XII. HÆMOPHILIA.

Definition.—An hereditary, constitutional fault, characterized by a tendency to uncontrollable bleeding, either spontaneous or from slight wounds. It is sometimes associated with a form of arthritis.

Early in the century several physicians of this country called attention to the occurrence of profuse hæmorrhage from slight causes. The fact that fatal hæmorrhage might occur from slight, trifling wounds had been known for centuries. The recognition of the family nature of the disease is due to the writings of Buel, Otto, Hay, Coates, and others in this country. The disease has been elaborately treated in the monographs of Legg and Grandidier.

Etiology.—In a majority of cases the disposition is hereditary. The fault may be acquired, however, but nothing is known of the conditions under which the disease may thus arise in healthy stock.

The hereditary transmission in this disease is remarkable. In the Appleton-Swain family, of Reading, Mass., there have been cases for nearly two centuries; and F. F. Brown, of that town, tells me that instances have already occurred in the seventh generation. The usual mode of transmission is through the mother, who is not herself a bleeder, but the daughter of one. Atavism through the female alone is almost the rule, and the daughters of a bleeder, though healthy and free from any tendency, are almost certain to transmit the disposition to the male offspring. The affection is much more common in males than in females,

the proportion being estimated at eleven to one, or even thirteen to one. The tendency usually appears within the first two years of life. It is rare for manifestations to be delayed until the tenth or twelfth year. Families in all conditions of life are affected. The bleeder families are usually large. The members are healthy-looking, and usually have fine, soft skins.

Morbid Anatomy.—No special peculiarities have been described. In some instances changes have been found in the smaller vessels; but in others careful studies have been negative. An unusual thinness of the vessels has been noted. Hæmorrhages have been found in and about the capsules of the joints, and in a few instances inflammation of the synovial surfaces. The nature of the disease is undetermined, and we do not yet know whether it depends upon a peculiar frailty of the blood-vessels or some peculiarity in the constitution of the blood, which prevents the normal thrombus formation in a wound.

Symptoms.—Usually hæmophilia is not noted in the child until a trifling cut is followed by serious or uncontrollable hæmorrhage, or spontaneous bleeding occurs and presents insuperable difficulties in its arrest. The symptoms may be grouped under three divisions: external bleedings, spontaneous and traumatic; interstitial bleedings, petechiæ and ecchymoses; and the joint affections. The external bleedings may be spontaneous, but more commonly they follow cuts and wounds. In 334 cases (Grandidier) the chief bleedings were epistaxis, 169; from the mouth, 43; stomach, 15; bowels, 36; urethra, 16; lungs, 17; and in a few instances bleeding from the skin of the head, the tongue, finger-tips, tear-papilla, eyelids, external ear, vulva, navel, and scrotum.

Traumatic bleeding may result from blows, cuts, scratches, etc., and the blood may be diffused into the tissues or discharged externally. Trivial operations have proved fatal, such as the extraction of teeth, circumcision, or venesection. It is possible that there may be local defects which make bleeding from certain parts of the body more dangerous. D. Hayes Agnew mentioned to me the case of a bleeder who had always bled from cuts and bruises above the neck, never from those below. The bleeding is a capillary oozing. It may last for hours, or even many days. Epistaxis may prove fatal in twenty-four hours. In the slow bleeding from the mucous surfaces large blood tumors may form and project from the nose or mouth, forming remarkable-looking structures, and showing that the blood has the power of coagulation. The interstitial hæmorrhages may be spontaneous, or may result from injury. Petechiæ or large extravasations—hæmatomata—may occur, the latter usually following blows.

The joint affections of hæmophilia are remarkable. There may simply be pain, or attacks which come on suddenly with fever, and closely resemble acute rheumatism. The larger joints are usually affected. Arthritis may usher in an attack of hæmorrhage.

So far as the examination of the blood goes, no changes of special moment have been noted. When the bleeding has been severe it is thin

and watery, but at the beginning of the bleeding the blood is rich in corpuscles and coagulates firmly.

Diagnosis.—In the diagnosis of the condition the family tendency is important. A single uncontrollable hæmorrhage in child or adult is not to be ranked as hæmophilia; but it is only when a person shows a marked tendency to multiple hæmorrhages, spontaneous or traumatic, which tendency is not transitory but persists, particularly if there have been joint affections, that we may consider the condition hæmophilia. Peliosis rheumatica is an affection which touches hæmophilia very closely, particularly in the relation of the joint swelling. It may also show itself in several members of a family. The diagnosis from the various forms of purpura is usually easy.

Prognosis. — The patients rarely die in the first bleeding. The younger the individual the worse is the outlook, though it is rarely fatal in the first year. Grandidier states that of 152 boy subjects, 81 died before the termination of the seventh year. The longer the bleeder survives the greater the chance of his outliving the tendency; but it may persist to old age, as shown in the case of Oliver Appleton, the first reported American bleeder, who died at an advanced age of hæmorrhage from a bed-sore and from the urethra. The prognosis is graver in a boy than in a girl. In the latter menstruation is sometimes early and excessive, but fortunately, in the female members of hæmophilic families, neither this function nor the act of parturition brings with it special dangers.

Treatment.—Members of a bleeder's family, particularly the boys, should be guarded from injury, and operations of all sorts should be avoided. The daughters should not marry, as it is through them that the tendency is propagated.

When an injury or wound has occurred, absolute rest and compression should first be tried, and if these fail the styptics may be used. In epistaxis ice, tannin, and gallic acid may be tried before resorting to plugging. Internally ergot seems to have done good in several cases. Legg advises the perchloride of iron in half-drachm doses every two hours with a purge of sulphate of soda. Venesection has been tried in several cases. Transfusion has been employed, but without success. During convalescence, iron and arsenic should be freely used.

SECTION III.

DISEASES OF THE DIGESTIVE SYSTEM.

I. DISEASES OF THE MOUTH.

STOMATITIS.

(1) **Acute Stomatitis.**—Simple or erythematous stomatitis, the commonest form of inflammation of the mouth, results from the action of irritants of various sorts. It is frequent at all ages. In children it is often associated with dentition and with gastro-intestinal disturbance, particularly in ill-nourished, unhealthy subjects. In adults it follows the overuse of tobacco and the use of too hot or too highly seasoned food. It is a frequent concomitant of indigestion, and is met with in the acute specific fevers.

The affection may be limited to the gums and lips or may extend over the whole surface of the mouth and include the tongue. There is at first superficial redness and dryness of the membrane, followed by increased secretion and swelling of the tongue, which is furred, and indented by the teeth. There is rarely any constitutional disturbance, but in children there may be slight elevation of temperature. The condition is sufficient to cause considerable discomfort, sometimes amounting to actual distress and pain, particularly in mastication.

In infants the mouth should be carefully sponged after each feeding. A mouth-wash of borax or the glycerine of borax may be used, and in severe cases, which tend to become chronic, a dilute solution of nitrate of silver (three or four grains to the ounce) may be applied.

(2) **Aphthous Stomatitis.**—This form, also known as *follicular* or *vesicular* stomatitis, is characterized by the presence of small, slightly raised spots, from two to four millimetres in diameter, surrounded by reddened areolæ. The spots appear first as vesicles, which rupture, leaving small ulcers with grayish bases and bright-red margins. They are seen most frequently on the inner surfaces of the lips, the edges of the tongue, and the cheeks. They are seldom present on the mucous membrane of the pharynx. This form is met with most often in children under three years. It may occur either as an independent affection or in association with any

one of the febrile diseases of childhood or with an attack of indigestion. The crop of vesicles comes out with great rapidity and the little ulcers may be fully formed within twenty-four hours. The child complains of soreness of the mouth and takes food with reluctance. The buccal secretions are increased, and the breath is heavy, but not foul. The constitutional symptoms are usually those of the disease with which the aphthæ are associated. The disease must not be confounded with thrush. No special parasite has been found in connection with it. It is not a serious condition, and heals rapidly with the improvement of the constitutional state. In severe cases it may extend to the pillars of the fauces and to the pharynx, and produce ulcers which are irritating and difficult to heal.

Each ulcer should be touched with nitrate of silver and the mouth should be thoroughly cleansed after taking food. A wash of chlorate of potash, or of borax and glycerine, may be used. The constitutional symptoms should receive careful attention.

(3) **Ulcerative Stomatitis.**—This form, which is also known by the names of *fetid stomatitis*, or *putrid sore mouth*, occurs particularly in children after the first dentition. It may prevail as a wide-spread epidemic in institutions in which the sanitary conditions are defective. It has been met with in jails and camps. Insufficient and unwholesome food, improper ventilation, and prolonged damp, cold weather seem to be special predisposing causes. Lack of cleanliness of the mouth, the presence of carious teeth, and the collection of tartar around them favor the development of the disease. The affection spreads like a specific disease, but the microbe has not yet been isolated. It has been held that the disease is the same as the foot-and-mouth disease of cattle, and that it is conveyed by the milk, but there is no positive evidence on these points. Payne suggests that the virus is identical with that of contagious impetigo.

The morbid process begins at the margin of the gums, which become swollen and red, and bleed readily. Ulcers form, the bases of which are covered with a grayish-white, firmly adherent membrane. In severe cases the teeth may become loosened and necrosis of the alveolar process may occur. The ulcers extend along the gum-line of the upper and lower jaws; the tongue, lips, and mucosa of the cheeks are usually swollen, but rarely ulcerated. There is salivation, the breath is foul, and mastication is painful. The submaxillary lymph glands are enlarged. The constitutional symptoms are often severe, and in institutions death sometimes results in the case of debilitated children.

In the treatment of this form of stomatitis chlorate of potash has been found to be almost specific. It should be given in doses of ten grains, three times a day, to a child, and to an adult double that amount. Locally it may be used as a mouth-wash, or the powdered salt may be applied directly to the ulcerated surfaces. When there is much fetor a

The epidemic in the neighborhood of Berlin 1888-1891, is claimed to have been coincident with the foot & mouth disease in cattle (D. M. W. 1891. Dec 3)

An exanthem often develops and may be mistaken for measles

Recurring outbreaks of vesicular herpetic, often pemphigoid, eruption are seen in neurotic individuals (Stomatitis neurotica chronica, Jacobi) In some cases it is associated with Erythema multiforme

Bednars aphthae consist of small aphthous patches as a rule
Ulcers in the hard palate caused in gums infants by the adjacent nipple. the nurses finger.

Lehrbuch der Kinderkrankheiten Wien
1856

permanganate-of-potash wash may be used, and an application of nitrate of silver may be made to the ulcers.

There are several *other varieties* of ulcerative sore mouth, which differ entirely from this form. Ulcers of the mouth are common in nursing women, and are usually seen on the mucous membrane of the lips and cheeks. They develop from the mucous follicles, and are from three to five millimetres in diameter. They may cause little or no inconvenience; but in some instances they are very painful and interfere seriously with the taking of food and its mastication. As a rule they heal readily after the application of nitrate of silver, and the condition is an indication for tonics, fresh air, and a better diet.

Parrot describes the occasional appearance in the new-born of small ulcers symmetrically placed on the hard palate on either side of the middle line. They are met with in very debilitated children. The ulcers rarely heal; usually they tend to increase in size, and may involve the bone.

(4) **Parasitic Stomatitis** (*Thrush; Soor; Muguet*).—This affection, most commonly seen in children, is dependent upon a fungus, the *saccharomyces albicans*, called by Robin the *oïdium albicans*. It belongs to the order of yeast fungi, and consists of branching filaments, from the ends of which ovoid torula cells develop. The disease does not arise apparently in a normal mucosa. The use of an improper diet, uncleanliness of the mouth, the acid fermentation of remnants of food, or the development, from any cause, of catarrhal stomatitis predispose to the growth of the fungus. In institutions it is frequently transmitted by unclean feeding-bottles, spoons, etc. It is not confined to children, but is met with in adults in the final stages of fever, in chronic tuberculosis, diabetes, and in cachectic states. The parasite develops in the upper layers of the mucosa, and the filaments form a dense felt-work among the epithelial cells. The disease begins on the tongue and is seen in the form of slightly raised, pearly-white spots, which increase in size and gradually coalesce. The membrane thus formed can be readily scraped off, leaving an intact mucosa, or, if the process extends deeply, a bleeding, slightly ulcerated surface. The disease spreads to the cheeks, lips, and hard palate, and may involve the tonsils and pharynx. In very severe cases the entire buccal mucosa is covered by the grayish-white membrane. It may even extend into the œsophagus and, according to Parrot, to the stomach and cæcum. It is occasionally met with on the vocal cords. Robust, well-nourished children are sometimes affected, but it is usually met with in enfeebled, emaciated infants with digestive or intestinal troubles. In such cases the disease may persist for months.

The affection is readily recognized, and must not be confounded with aphthous stomatitis, in which the ulcers, preceded by the formation of vesicles, are perfectly distinctive. In thrush the microscopical examina-

tion shows the presence of the characteristic fungus throughout the membrane. In this condition, too, the mouth is usually dry—a striking contrast to the salivation accompanying aphthæ.

Thrush is more readily prevented than removed. The child's mouth should be kept scrupulously clean, and, if artificially fed, the bottles should be thoroughly sterilized. Lime-water or any other alkaline fluid, such as the bicarbonate of soda (a drachm to a tumbler of water), may be employed. When the patches are present these alkaline mouth-washes may be continued after each feeding. A spray of borax or of sulphite of soda (a drachm to the ounce) or the black wash with glycerine may be employed. The permanganate of potassium is also useful. The constitutional treatment is of equal importance, and it will often be found that the thrush persists, in spite of all local measures, until the general health of the infant is improved by change of air or the relief of the diarrhœa, or, in obstinate cases, the substitution of a natural for the artificial diet.

(5) **Gangrenous Stomatitis** (*Cancrum Oris; Noma*).—An affection characterized by a rapidly progressing gangrene, starting on the gums or cheeks, and leading to extensive sloughing and destruction. This terrible but fortunately rare disease is seen only in children under very insanitary conditions or during convalescence from the acute fevers. It is more common in girls than in boys. It is met with between the ages of two and five years. In at least one half of the cases the disease has developed during convalescence from measles. Cases have been seen also after scarlet fever and typhoid. The mucous membrane is first affected, usually of the gums or of one cheek. It begins insidiously, and when first seen there is a sloughing ulcer of the mucous membrane, which spreads rapidly and leads to brawny induration of the skin and adjacent parts. The sloughing extends, and in severe cases the cheek is perforated. The disease may spread to the tongue and chin; it may invade the bones of the jaws and even involve the eyelids and ears. In mild cases an ulcer forms on the inner surface of the cheek, which heals or may perforate and leave a fistulous opening. Naturally in such a severe affection the constitutional disturbance is very great, the pulse is rapid, the prostration extreme, and death usually takes place within a week or ten days. The temperature may reach 103° or 104°. Diarrhœa is usually present, and aspiration pneumonia often develops. H. R. Wharton has described a case in which there was extensive colitis. Lingard has found in cases of noma a thread-like bacillus, but its precise relation to the disease is doubtful. The highly refractile bodies described by Sansom in the blood were probably blood-plates.

The treatment of the disease is unsatisfactory. In many cases the onset is so insidious that there is an extensive sloughing sore when the case first comes under observation. Destruction of the sore by the cautery, either the Paquelin or fuming nitric acid, is the most effectual. Antisep-

tic applications should be made to destroy the fetor. The child should be carefully nourished and stimulants given freely.

(6) **Mercurial Stomatitis** (*Ptyalism*).—An inflammation of the mouth and salivary glands caused by mercury, which occurs chiefly in persons who have a special susceptibility, and rarely now as a result of the excessive use of the drug. It is met with also in persons whose occupation necessitates the constant handling of mercury. It often follows the administration of repeated small doses. Thus, a patient with heart disease who was ordered an eighth of a grain of calomel every three hours for diuretic purposes had, after taking eight or ten doses, a severe stomatitis, which persisted for several weeks. I have known it to follow also the administration of small doses of gray powder. The patient complains first of a metallic taste in the mouth, the gums become swollen, red, and sore, mastication is difficult, and soon there is a great increase in the secretion of the saliva, which flows freely from the mouth. The tongue is swollen, the breath has a foul odor, and, if the affection progresses, there may be ulceration of the mucosa, and, in rare instances, necrosis of the jaw. Although troublesome and distressing, the disease is rarely serious, and recovery usually takes place in a couple of weeks. Instances in which the teeth become loosened or detached or in which the inflammation extends to the pharynx and Eustachian tubes are rarely seen now.

The administration of mercury should be suspended so soon as the gums are "touched." Mild cases of the affection subside within a few days and require only a simple mouth-wash. In severer cases the chlorate of potash may be given internally and used to rinse the mouth. The bowels should be freely opened; the patient should take a hot bath every evening and should drink plentifully of alkaline mineral waters. Atropine is sometimes serviceable, and may be given in doses of one one hundredth of a grain twice a day. Iodine is also recommended. When the salivation is severe and protracted the patient becomes much debilitated, anæmia develops, and a supporting treatment is indicated. The diet is necessarily liquid, for the patient finds the chief difficulty in taking food. If the pain is severe a Dover powder may be given at night.

Here may be appropriately mentioned the influence of stomatitis, particularly the mercurial form, upon the developing teeth of children. The condition known as *erosion*, in which the teeth are honeycombed or pitted owing to defective formation of enamel, is indicative as a rule of infantile stomatitis. Such teeth must be distinguished carefully from those of congenital syphilis, which may of course coexist, but the two conditions are distinct. The honeycombing is frequently seen on the incisors; but, according to Jonathan Hutchinson, the test teeth of infantile stomatitis are the first permanent molars, then the incisors, "which are almost as constantly pitted, eroded, and of bad color, often showing the transverse furrow which crosses all the teeth at the same level." Magitot regards these transverse furrows as the result of infantile convulsions or

of severe illnesses during early life. He thinks they are analogous to the furrows on the nails which so often follow a serious disease.

II

II. DISEASES OF THE SALIVARY GLANDS.

1. **Hypersecretion** (*Ptyalism*).—The normal amount of saliva varies from two to three pints in the twenty-four hours. The secretion is increased during the taking of food and in the physiological processes of dentition. A great increase, to which the term *ptyalism* is applied, is met with under many circumstances. It occurs occasionally in mental and nervous affections and in rabies. Occasionally it is seen in the acute fevers, particularly in small-pox. It has been met with during gestation, usually early, though it may persist throughout the entire course. It has been known to occur at each menstrual period; and, lastly, it is a common effect of certain drugs. Mercury, gold, copper, the iodine compounds, and (among vegetable remedies) jaborandi, muscarin, and tobacco excite the salivary secretion. Of these we most frequently see the effect of mercury in producing ptyalism. The salivation may be present without any inflammation of the mouth.

2. **Xerostomia** (*Arrest of the Salivary and Buccal Secretions; Dry Mouth*).—In this condition, first described by Jonathan Hutchinson, the secretions of the mouth and salivary glands are suppressed. The tongue is red, sometimes cracked, and quite dry; the mucous membrane of the cheeks and of the palate is smooth, shining, and dry; and mastication, deglutition, and articulation are very difficult. The condition is not common. A majority of the cases are in women, and in several instances have been associated with nervous phenomena. The general health, as a rule, is unimpaired. Hadden suggests that it is due to involvement of some centre which controls the secretion of the salivary and buccal glands. A well-marked case came under my observation in a man aged thirty-two, who was sent to me by Donald Baynes on account of a peculiar growth along the gums. This proved to be the remnants of food which, owing to the absence of any salivary or buccal secretions, collected along the gums, became hardened, and adhered to them. The condition lasted for three weeks, and was cured by the galvanic current.*

3. **Inflammation of the Salivary Glands.**

(*a*) *Specific Parotitis.* (See MUMPS.)

(*b*) *Symptomatic parotitis* or *parotid bubo* occurs:

(1) In the course of the infectious fevers—typhus, typhoid, pneumonia, pyæmia, etc. In ordinary practice it occurs oftenest, perhaps, in typhoid fever. It is the result either of septic infection through the blood, or the in-

* Canada Medical and Surgical Journal, vol. v, p. 439, 1877.

II Diseases of the Tongue.

1 Symptoms of the tongue in general diseases

i Desquam of epith.

ii Leucoplacia

iii Strawberry Tongue. Med news. Oct. 1893

There are two affections of the tongue which I find are not well recognized by practitioners.

See Les inflections Salivaires.
a. f. Exp. Med. 1. 94

I have seen recently a case of parotitis in secondary syphilis

(c) Chronic parotitis a condition in which the glands are enlarged, sometimes painful, has been described following in one case inflammation of the throat, in another mumps Salivation may be present. It may be due to lead or mercury.

(case seen at Dispensary. 3.28.94

flammation, in many cases, passes up the salivary duct and so reaches the gland. The process is usually very intense and leads rapidly to suppuration. It is, as a rule, an unfavorable indication in the course of a fever.

(2) In connection with injury or disease of the abdomen or pelvis, a condition to which Stephen Paget has called special attention. Of 101 cases of this kind, "10 followed injury or disease of the urinary tract, 18 were due to injury or disease of the alimentary canal, and 23 were due to injury or disease of the abdominal wall, the peritonæum, or the pelvic cellular tissue. The remaining 50 were due to injury, disease, or temporary derangement of the genital organs." By temporary derangement is meant slight injuries or natural processes—a slight blow on the testis, the introduction of a pessary, menstruation, or pregnancy. He states that this form of parotitis is not, as a rule, associated with signs of septicæmia or pyæmia. It may occur in connection with gastric ulcer. Of the 101 cases 37 died, the majority of them not from the parotitis, but from the primary lesion with which it was associated. After an operation it occurs usually within the first week, often on the seventh day. There may be pyrexia, but many cases are afebrile. One gland is usually attacked, but both may be involved. In 78 cases in which the termination was noted 45 suppurated and 33 resolved without suppuration. The etiology of this form of parotitis is obscure. Many of the cases are undoubtedly septic.

(3) In association with facial paralysis, as in a case of fatal peripheral neuritis described by Gowers.

In the treatment of parotid bubo the application of half a dozen leeches will sometimes reduce the inflammation and promote resolution. When suppuration seems inevitable hot fomentations should be applied. A free incision should be made *early*.

III. DISEASES OF THE PHARYNX.

(1) **Circulatory Disturbances.**—(*a*) *Hyperæmia* is a common condition in acute and chronic affections of the throat, and is frequently seen as a result of the irritation of tobacco smoke. Venous stasis is seen in valvular disease of the heart, and in mechanical obstruction of the superior vena cava by tumor or aneurism. In aortic insufficiency the capillary pulse may sometimes be seen and the intense throbbing of the internal carotid may be mistaken for aneurism.

(*b*) *Hæmorrhage* is found in association with bleeding from other mucous surfaces, or it is due to local causes in the pharynx itself. In the latter case it may be mistaken for hæmorrhage from the lungs or stomach. The bleeding may come from granulations or vegetations in the naso-pharynx. Sometimes the patient finds the pillow stained in the morning with bloody secretion. The condition is rarely serious, and only

requires suitable local treatment of the pharynx. Occasionally a hæmorrhage takes place into the mucosa, producing a pharyngeal hæmatoma. I have thrice seen a condition of the uvula resembling hæmorrhagic infarction. One was in a patient with acute rheumatism, to whom large doses of salicylic acid had been given; the other two were instances of peliosis rheumatica, in both of which partial sloughing of the uvula took place.

(*c*) *Œdema.*—An infiltrated œdematous condition of the uvula and adjacent parts is not very uncommon in conditions of debility, in profound anæmia, and in Bright's disease. The uvula is sometimes from this cause enormously enlarged, and may lead to difficulty in swallowing or in breathing.

(2) **Acute Pharyngitis** (*Sore Throat; Angina Simplex*).—The entire pharyngeal structures, often with the tonsils, are involved. The condition may follow cold or exposure. In other instances it is associated with constitutional states, such as rheumatism or gout, or with digestive disorders. The patient complains of uneasiness and soreness in swallowing, of a feeling of tickling and dryness in the throat, together with a constant desire to hawk and cough. Frequently the inflammation extends into the larynx and produces hoarseness. Not uncommonly it is only part of a general naso-pharyngeal catarrh. The process may pass into the Eustachian tubes and cause slight deafness. There is stiffness of the neck, the lymph glands of which may be enlarged and painful. The constitutional symptoms are rarely severe. The disease sets in with a chilly feeling and slight fever, and the pulse is increased in frequency. Occasionally the febrile symptoms are more severe, particularly if the tonsils are specially involved. The examination of the throat shows general congestion of the mucous membrane, which is dry and glistening, and in places covered with sticky secretion. The uvula may be much swollen.

Acute pharyngitis lasts only a few days and requires mild measures. If the tonsils are involved and the fever is high, aconite or sodium salicylate may be given. Guaiacum also is beneficial; but in a majority of the cases a calomel purge or a saline aperient and inhalations with steam meet the indications.

(3) **Chronic Pharyngitis.**—This may follow repeated acute attacks. It is very common in persons who smoke or drink to excess, and in those who use the voice very much, such as clergymen, hucksters, and others. It is frequently met with in chronic nasal catarrh. The naso-pharynx and the posterior wall are the parts most frequently affected. The mucous membrane is relaxed, the venules are dilated, and roundish bodies, from two to four millimetres in diameter, reddish in color, project to a variable distance beyond the mucous membrane. These represent the proliferations of lymph tissue about the mucous glands. They may be very abundant, forming elongated rows in the lateral walls of the pharynx. With this there may be a dry glistening state of the

pharyngeal mucosa, sometimes known as *pharyngitis sicca*. The pillars of the fauces, and the uvula are often much relaxed. The secretion forms at the back of the pharynx and the patient may feel it drop down from the vault, or it is tenacious and adherent, and is only removed by repeated efforts at hawking.

In the *treatment*, special attention must be paid to the general health. If possible, the cause should be ascertained. The condition is almost constant in smokers, and cannot be cured without stopping the use of tobacco. The use of food either too hot or too much spiced should be forbidden. When it depends upon excessive exercise of the voice, rest should be enjoined. In many of these cases change of air and tonics help very much. In the local treatment of the throat gargles, washes, and pastilles of various sorts give temporary relief, but when the hypertrophic condition is marked the spots should be thoroughly destroyed by the galvanocautery. In many instances this affords great and permanent relief, but in others the condition persists, and as it is not unbearable, the patient gives up all hope of permanent relief.

(4) **Ulceration of the Pharynx.**—(*a*) Follicular. The ulcers are usually small, superficial, and generally associated with chronic catarrh.

(*b*) Syphilitic ulcers are usually painless, and most frequently situated on the posterior wall of the pharynx. They occur in the secondary stage as small, shallow excavations with the mucous patches. In the tertiary stage the ulcers are due to erosion of gummata, and in healing they leave whitish cicatrices.

(*c*) Tuberculous ulceration is not very uncommon in advanced cases of phthisis, and, if extensive, is one of the most distressing features of the later stages of the disease. The ulcers are irregular, with ill-defined edges and grayish-yellow bases. The posterior wall of the pharynx may have an eroded, worm-eaten appearance. These ulcers are, as a rule, intensely painful.

(*d*) Ulcers occur in connection with pseudo-membranous inflammation, particularly the diphtheritic. In cancer and in lupus ulcers are also present.

(*e*) Ulcers are met with in certain of the fevers, particularly in typhoid.

In many instances the diagnosis of the nature of pharyngeal ulcers is very difficult. The tuberculous and cancerous varieties are readily recognized, but it happens not infrequently that a doubt arises as to the syphilitic character of an ulcer. In many instances the local conditions may be uncertain. Then other evidences of syphilis should be sought for, and the patient should be placed on mercury and iodide of potassium, under which remedies syphilitic ulcers usually heal with great rapidity.

(5) **Acute Infectious Phlegmon of the Pharynx.**—Under this term Senator has described cases in which, along with difficulty in swallowing, soreness of the throat, and sometimes hoarseness, the neck enlarges, the

pharyngeal mucosa becomes swollen and injected, the fever is high, the constitutional symptoms are severe, and the inflammation passes on rapidly to suppuration. The symptoms are very intense. The swelling of the pharyngeal tissues early reaches such a grade as to impede respiration. Very similar symptoms may be produced by the lodgment of foreign bodies in the pharynx.

(6) **Retro-pharyngeal Abscess.**—This may occur as a sequel to one of the fevers, but more commonly results from caries of the cervical vertebræ. It is accompanied with pain in swallowing, sometimes with cough, dyspnœa, and alterations in the character of the voice.

The diagnosis is readily made, as the projecting tumor can be seen, and felt with the finger on the posterior wall of the pharynx.

(7) **Angina Ludovici** (*Ludwig's Angina; Cellulitis of the Neck*).—In medical practice this is seen as a secondary inflammation in the specific fevers, particularly diphtheria and scarlet fever. It may, however, occur idiopathically or result from trauma. It is probably always a streptococcus infection which spreads rapidly from the glands. The swelling at first is most marked in the submaxillary region of one side. The symptoms are, as a rule, intense, and, unless early and thorough surgical measures are employed, there is great risk of systemic infection.

IV. DISEASES OF THE TONSILS.

Apart from the affection of these glands already described in connection with diphtheria, scarlet fever, and syphilis, an acute and a chronic tonsillitis may be recognized.

ACUTE TONSILLITIS.

(1) **Follicular or Lacunar Tonsillitis.**—For practical purposes, under this name may be described the various forms which have been called catarrhal, erythematous, ulcero-membranous, and herpetic.

Etiology.—The disease is met with most frequently in young persons, but in children under ten it is less common than the chronic form. It is rare in infants. Sex has no special influence. Exposure to wet and cold, and bad hygienic surroundings appear to have a direct etiological connection with the disease. In so many instances defective drainage has been found associated with outbreaks of follicular tonsillitis that sewer-gas is regarded as a common exciting cause. One attack renders a patient more liable to subsequent infection. Special stress is laid by some writers upon the coexistence of tonsillitis with rheumatism. Cheadle describes it as one of the phases of rheumatism in childhood with which articular attacks may alternate. I cannot say that, in my experience, the connection

1 ~~This~~ may occurs (1) in healthy children between six months and two years. The child becomes restless - the voice changes - and may be nasal or metallic in tone - and there are may be pain and difficulty in swallowing. Inspection of the pharynx reveals a projecting tumor in the middle line - or it may not be visible - but is readily felt on palpation projecting from the posterior wall. This is form has been carefully described by Koplik.

(2) Retropharyngeal abscess is a not an infrequent sequel of the fevers - particularly of scarlet fever and diphtheria.

(3) The tuberculous abscess from caries of the bodies of the cervical vertebrae is by no means uncommon.

Felix Semon holds that the various acute septic inflammations of the throat - acute oedema of the larynx, phlegmon of the pharynx and larynx and angina Ludovici - "represent degrees varying in virulence of one and the same process"

between the two affections has been very striking, except in one point, viz., that an attack of acute rheumatism is not infrequently preceded by inflammation of the tonsils. The existence of pains in the limbs is no evidence of the connection of the affection with rheumatism. A disease so common and wide-spread as acute tonsillitis necessarily attacks many persons in whose families rheumatism prevails or who may themselves have had acute attacks.

Mackenzie gives a table showing that in four successive years more cases occurred in September than in any other month; in October nearly as many; with July, August, and November next. In this country it seems more prevalent in the spring. So many cases develop within a short time that the disease may be almost epidemic. It spreads through a family in such a way that it must be regarded as contagious.

An old notion prevails that there is a definite relation between the tonsils and the testes and ovaries. F. J. Shepherd has called attention to the circumstance that acute tonsillitis is a very common affection in newly married persons. That view is probably correct which regards tonsillitis as a local disease with severe constitutional manifestations, although the fever is often high in proportion to the local symptoms. The commonest organism found in tonsillitis is a streptococcus. Staphylococci also occur. In some cases organisms closely resembling the *bacillus diphtheriæ* of Loeffler have been found, but they do not seem to possess the same malignancy.

Morbid Anatomy.—The lacunæ of the tonsils become filled with exudation products, which form cheesy-looking masses, projecting from the orifices of the crypts. Not infrequently the exudations of contiguous lacunæ coalesce. The intervening mucosa is usually swollen, deep-red in color, and may present herpetic vesicles or, in some instances, even membranous exudation, in which case it may be difficult to distinguish the condition from diphtheria. The creamy contents of the crypt are made up of micrococci and epithelial *débris*.

Symptoms.—Chilly feelings, or even a definite chill, and aching pains in the back and limbs may precede the onset. The fever rises rapidly, and in the case of a young child may reach 105° on the evening of the first day. The patient complains of soreness of the throat and difficulty in swallowing. On examination, the tonsils are seen to be swollen and the crypts present the characteristic creamy exudate. The tongue is furred, the breath is heavy and foul, and the urine is highly colored and loaded with urates. In children the respirations are usually very hurried, and the pulse is greatly increased in rapidity. Swallowing is painful, and the voice often becomes nasal. Slight swelling of the cervical glands is present. In severe cases the symptoms increase and the tonsils become still more swollen. The inflammation gradually subsides, and, as a rule, within a week the fever departs and the local symptoms greatly improve. The tonsils, however, remain somewhat swollen. The prostration and

constitutional disturbance are often out of proportion to the intensity of the local disease.

There are complications which occasionally excite uneasiness. Febrile albuminuria is not uncommon, as Haig-Brown has pointed out. Cases of endocarditis or pericarditis have been found. It is to be borne in mind that in children an apex systolic murmur is by no means uncommon at the height of any fever. The disease may extend to the middle ear. The development of paralytic symptoms, local or general, after an attack which has been regarded as follicular tonsillitis indicates an error in diagnosis.

Diagnosis.—It may be difficult to distinguish follicular tonsillitis from diphtheria. It would seem, indeed, as if there were intermediate forms between the mildest lacunar and the severer pseudo-membranous tonsillitis. In the follicular form the individual yellowish-gray masses, separated by the reddish tonsillar tissue, are very characteristic; whereas in diphtheria the membrane is of ashy gray, and uniform, not patchy. A point of the greatest importance in diphtheria is that the membrane is not limited to the tonsils, but creeps up the pillars of the fauces or appears on the uvula. The diphtheritic membrane when removed leaves a bleeding, eroded surface; whereas the exudation of lacunar tonsillitis is easily separated, and there is no erosion beneath it. In all doubtful cases cultures should, if possible, be made to determine the presence of Loeffler's bacillus.

(2) **Suppurative Tonsillitis.**

Etiology.—This arises under conditions very similar to those mentioned in the lacunar form. It may follow exposure to cold or wet, and is particularly liable to recur. It is most common in adolescence. The inflammation is here more deeply seated. It involves the stroma, and tends to go on to suppuration.

Symptoms.—The constitutional disturbance is very great. The temperature rises to 104° or 105°, and the pulse ranges from 110 to 130. Nocturnal delirium is not uncommon. The prostration may be extreme. There is no local disease of similar extent which so rapidly exhausts the strength of a patient. Soreness and dryness of the throat, with pain in swallowing, are the symptoms of which the patient first complains. One or both tonsils may be involved. They are enlarged, firm to the touch, dusky red and œdematous, and the contiguous parts are also much swollen. The swelling of the glands may be so great that they meet in the middle line, or one tonsil may even push the uvula aside and almost touch the other gland. The salivary and buccal secretions are increased. The glands of the neck enlarge, the lower jaw is fixed, and the patient is unable to open his mouth. In from two to four days the enlarged gland becomes softer, and fluctuation can be distinctly felt by placing one finger on the tonsil and the other at the angle of the jaw. The abscess usually points toward the mouth, but it may point toward the pharynx. It may burst spontaneously, affording instant and great relief. Suffocation has

A diffuse erythema may develop - simulating scarlet fever.

(See Suffolk)

followed the rupture of a large abscess and the entrance of the pus into the larynx. When the suppuration is peritonsillar and extensive, the internal carotid artery may be opened; but these are, fortunately, very rare accidents.

Treatment.—In the follicular form aconite may be given in full doses. It acts very beneficially in children. The salicylates, given freely at the outset, are regarded by some as specific, but I have seen no evidence of such prompt and decisive action. At night, a full dose of Dover's powder may be given. The use of guaiacum, in the form of two-grain lozenges, is warmly recommended. Iron and quinine should be reserved until the fever has subsided. A pad of spongio-piline or thick flannel dipped in ice-cold water may be applied around the neck and covered with oiled silk. More convenient still is a small ice-bag. Locally the tonsils may be treated with the dry sodium bicarbonate. The moistened finger-tip is dipped into the soda, which is then rubbed gently on the gland and repeated every hour. Astringent preparations, such as iron and glycerine, alum, zinc, and nitrate of silver, may be tried. To cleanse and disinfect the throat, solutions of borax or thymol in glycerine and water may be used.

In suppurative tonsillitis hot applications in the form of poultices and fomentations are more comfortable and better than the ice-bag. The gland should be felt—it cannot always be seen—from time to time, and should be opened when fluctuation is distinct. The progress of the disease may be shortened and the patient spared several days of great suffering if the gland is scarified early. The curved bistoury, guarded nearly to the point with plaster or cotton, is the most satisfactory instrument. The incision should be made from above downward, parallel with the anterior pillar. There are cases in which, before suppuration takes place, the parenchymatous swelling is so great that the patient is threatened with suffocation. In such instances the tonsil must either be excised or tracheotomy or, possibly, intubation performed. Delavan refers to two cases in which he states that tracheotomy would, under these circumstances, have saved life. Patients with this affection require a nourishing liquid diet, and during convalescence iron in full doses.

CHRONIC TONSILLITIS.

(*Chronic Naso-pharyngeal Obstruction; Mouth-Breathing; Aprosexia.*)

Under this heading will be considered also hypertrophy of the adenoid tissue in the vault of the pharynx, sometimes known as the pharyngeal tonsil, as the affection usually involves both the tonsils proper and this tissue, and the symptoms are not to be differentiated.

Chronic enlargement of the tonsillar tissues is an affection of great importance, and may influence in an extraordinary way the mental and bodily development of children.

Etiology.—Hypertrophy of the tonsillar structures is occasionally congenital. Cases are perhaps most frequent in children, during the third hemi-decade. The condition also occurs in young adults, more rarely in the middle-aged. The enlargement may follow diphtheria or the eruptive fevers. The frequency of the occurrence of adenoid growths in the naso-pharynx has been variously stated. Meyer, to whom the profession is indebted for calling attention to the subject, found them in about one per cent of the children in Copenhagen, while Chappell found sixty cases in the examination of two thousand children in New York. These figures give a very moderate estimate of the prevalence of the trouble. It occurs equally in boys and girls, according to some writers with greater prevalence in the former.

Morbid Anatomy.—The tonsils proper present a condition of chronic hypertrophy, due to multiplication of all the constituents of the glands. The lymphoid elements may be chiefly involved without much development of the stroma. In other instances the fibrous matrix is increased, and the organ is then harder, smaller, firmer, and is cut with much greater difficulty.

The adenoid growths, which spring from the vault of the pharynx, form masses varying in size from a small pea to an almond. They may be sessile, with broad bases, or pedunculated. They are reddish in color, of moderate firmness, and contain numerous blood-vessels. "Abundant, as a rule, over the vault, on a line with the fossa of the Eustachian tube, the growths may lie posterior to the fossa—namely, in the depression known as the fossa of Rosenmüller, or upon the parts which are parallel to the posterior wall of the pharynx. The growths appear to spring in the main from the mucous membrane covering the localities where the connective tissue fills in the inequalities of the base of the skull" (Harrison Allen). The growths are most frequently papillomatous with a lymphoid parenchyma. Hypertrophy of the pharyngeal adenoid tissue may be present without great enlargement of the tonsils proper. Chronic catarrh of the nose usually coexists.

Symptoms.—The direct effect of chronic tonsillar hypertrophy is the establishment of mouth-breathing. The indirect effects are deformation of the thorax, changes in the facial expression, and sometimes marked alteration in the mental condition. The establishment of mouth-breathing is the symptom which first attracts the attention. It is not so noticeable by day, although the child may present the vacant expression characteristic of this condition. At night the child's sleep is greatly disturbed; the respirations are loud and snorting, and there are sometimes prolonged pauses, followed by deep, noisy inspirations. The child may wake up in a paroxysm of shortness of breath. Some of these nocturnal attacks may be due to reflex spasm of the glottis.

When the mouth-breathing has persisted for a long time definite changes are brought about in the face, mouth, and chest. The facies is

Shut your mouth. Listen.

and in certain cases stunting of the growth. Woods Hutchinson has suggested that a possible relation of these stigmata with the pituitary body may account for this interference with development.

(*) The pulse may vary strongly during these attacks, in the prolonged intervals may be slow, to increase greatly with the forced inspirations

The alæ nasi should be observed during the sleep of the child, as they are sometimes much retracted during inspiration due to a laxity of the walls. — a condition readily remedied by the use of a rest nose dilator.

During the day, with enlarged tonsils there may be choking fits when eating.

Look at teeth.

Barrel chest and asthma.

Trachea bent.

Harrison Grove.

(Harrisons grove)

Ikeu

Ike

so peculiar and distinctive that the condition may be evident at a glance. The expression is dull, heavy, and apathetic, due in part to the fact that the mouth is habitually left open. In long-standing cases the child is very stupid-looking, responds slowly to questions, and may be sullen and cross. The lips are thick, the nasal orifices small and pinched-in looking, and in the mouth the superior dental arch is narrowed and the roof considerably raised.

The remarkable alterations in the shape of the chest in connection with enlarged tonsils were first studied by Dupuytren and J. Mason Warren. They are liable to be mistaken for those of rickets. It is the commonest cause of chest deformity in this country. "Anteriorly the ribs are prominent, the sternum is angulated forward at the manubrio-gladiolar junction and grooved at the gladiolo-xiphoid junction. A saucer-shaped depression is often found at the lower costal cartilages. The lower angle of the scapula projects. While the ribs are separated far from each other anteriorly they are so closely pressed together posteriorly, especially at the lower part of the chest, as to have the intercostal spaces practically obliterated" (Harrison Allen). The prominent sternum (chicken breast) with the circular depression in the lateral zones corresponding to the attachment of the diaphragm are the most characteristic features. During sleep, in a chronic mouth-breather, with each inspiration the diaphragm may be seen to draw in the lower and lateral thoracic regions.

The voice is altered and acquires a nasal quality. The pronunciation of certain letters is changed, and there is inability to pronounce the nasal consonants *n* and *m*. Bloch, in his monograph,* lays great stress upon the association of mouth-breathing with stuttering.

The hearing is impaired, usually owing to the extension of inflammation along the Eustachian tube and its obstruction with mucus or the narrowing of its orifice by pressure of the adenoid vegetations. In some instances it may be due to retraction of the drums, as the upper pharynx is insufficiently supplied with air. Naturally the senses of taste and smell are much impaired. With these symptoms there may be little or no nasal catarrh or discharge, but the pharyngeal secretion of mucus is always increased. Children, however, do not notice this, as the mucus is usually swallowed, but older persons expectorate it with difficulty.

Among other symptoms may be mentioned headache, which is by no means uncommon, general listlessness, and an indisposition for physical or mental exertion. Habit-spasm of the face has been described in connection with it. I have known several instances in which permanent relief has been afforded by the removal of the adenoid vegetations. Enuresis is occasionally an associated symptom. The influence upon the mental development is striking. Mouth-breathers are usually dull, stupid, and backward. It is impossible for them to fix the attention for long at a

* Die Pathologie und Therapie der Mundathmung. Wiesbaden, 1889.

time, and to this impairment of the mental function Guye, of Amsterdam, has given the name *aprosexia.* Headaches, forgetfulness, inability to study without discomfort, are frequent symptoms of this condition in students. The practitioner must bear in mind that all of these symptoms may be found in connection with adenoid growths in the vault of the pharynx without especial enlargement of the tonsils, and that both in diagnosis and treatment particular attention must be paid to the former.

A symptom specially associated with enlarged tonsils is fetor of the breath. In the tonsillar crypts the inspissated secretion undergoes decomposition and an odor not unlike that of Rochefort or Limburger cheese is produced. The little cheesy masses may sometimes be squeezed from the crypts of the tonsils. Though the odor may not apparently be very strong, yet if the mass be squeezed between the fingers its intensity will at once be appreciated. In some cases of chronic enlargement the cheesy masses may be deep in the tonsillar crypts; and if they remain for a prolonged period lime salts are deposited and a tonsillar calculus in this way produced.

Children with enlarged tonsils are especially prone to take cold and to recurring attacks of follicular disease. They are also more liable to diphtheria, and in them the anginal features in scarlet fever are always more serious.

Diagnosis.—Enlarged tonsils are readily seen on inspection of the pharynx. There may be no great enlargement of the tonsils and nothing apparent at the back of the throat even when the naso-pharynx is completely blocked with adenoid vegetations. In children the rhinoscopic examination is rarely practicable. Digital examination is the most satisfactory. The growths can then be felt either as small, flat bodies or, if extensive, as velvety, grape-like papillomata.

Treatment.—If the tonsils are large and the general state is evidently influenced by them they should be at once removed. Applications of iodine and iron, or pencilling the crypts with nitrate of silver, are of service in the milder grades, but it is waste of time to apply them in very enlarged glands. There is a condition in which the tonsils are not much enlarged, but the crypts are constantly filled with cheesy secretions and cause a very bad odor in the breath. In such instances the removal of the secretion and thorough pencilling of the crypts with chromic acid may be practised. The galvano-cautery is of great service in many cases of enlarged tonsils when there is any objection to the more radical surgical procedure.

The treatment of the adenoid growths in the pharynx is of the greatest importance, and should be thoroughly carried out. Parents should be frankly told that the affection is serious, one which impairs the mental not less than the bodily development of the child. In spite of the thorough ventilation of this subject by specialists, practitioners do not appear to have grasped as yet the full importance of this disease. They

habitus.

The facial aspect is usually distinctive.

The ultimate results of untreated adenoid hypertrophy are important. In some cases the vegetations disappear leaving an atrophic condition of the result of the hypertrophy. Neglect may also lead to the so-called "Thornwaldt disease" in which

(See Determann Med Record 1894)

are far too apt to temporize and to postpone unnecessarily radical measures. The child must be etherized, when the growths can be removed either with the finger-nail, which in most instances is sufficient, or with a suitable curette. Considerable hæmorrhage may follow, but it is usually checked quickly. The good effects of the operation are often apparent within a few days, and the child begins to breathe through the nose. In some instances the habit of mouth-breathing persists. As soon as the child goes to sleep the lower jaw drops and the air is drawn into the mouth. In these cases a chin strap can be readily adjusted, which the child may wear at night. In severe cases it may take months of careful training before the child can speak properly.

Throughout the entire treatment attention should be paid to hygiene and diet, and cod-liver oil and the iodide of iron may be administered with benefit.

V. DISEASES OF THE ŒSOPHAGUS.

I. ACUTE ŒSOPHAGITIS.

Etiology.—Acute inflammation occurs (*a*) in the catarrhal processes of the specific fevers; more rarely as an extension from catarrh of the pharynx. (*b*) As a result of intense mechanical or chemical irritation, produced by foreign bodies, by very hot liquids, or by strong corrosives. (*c*) In the form of pseudo-membranous inflammation in diphtheria, and occasionally in pneumonia, typhoid fever, and pyæmia. (*d*) As a pustular inflammation in small-pox, and, according to Laennec, as a result of a prolonged administration of tartar emetic. (*e*) In connection with local disease, particularly cancer either of the tube itself or extension to it from without. And, lastly, acute œsophagitis, occasionally with ulceration, may occur spontaneously in sucklings.

Morbid Anatomy.—It is extremely rare to see redness of the mucosa, except when chemical irritants have been swallowed. More commonly the epithelium is thickened and has desquamated, so that the surface is covered with a fine granular substance. The mucous follicles are swollen and occasionally there may be seen small erosions. In the pseudo-membranous inflammation there is a grayish croupous exudate, usually limited in extent, at the upper portion of the gullet. This must not be confounded with the grayish-white deposit of thrush in children. The pustular disease is very rare in small-pox. In the phlegmonous inflammation the mucous membrane is greatly swollen, and there is purulent infiltration in the submucosa. This may be limited as about a foreign body, or extremely diffuse. It may even extend throughout a large part of the gullet. Gangrene occasionally supervenes. Birch-Hirschfeld describes a

remarkable case in an hysterical woman, who vomited a long membranous tube which proved, on examination, to be the detached epithelial lining of the œsophagus. Practically, in post-mortem work, there is no portion of the alimentary canal which more rarely shows signs of disease.

Symptoms.—Pain in deglutition is always present in severe inflammation of the œsophagus, and in the form which follows the swallowing of strong irritants may prevent the taking of food. A dull pain beneath the sternum is also present. In the milder forms of catarrhal inflammation there are usually no symptoms. The presence of a foreign body is indicated by dysphagia and spasm with the regurgitation of portions of the food. Later, blood and pus may be ejected. It is surprising how extensive the disease may be in the œsophagus without producing much pain or great discomfort, except in swallowing. The intense inflammation which follows the swallowing of corrosives, when not fatal, gradually subsides, and often leads to cicatricial contraction and stricture.

The *treatment* of acute inflammation of the œsophagus is extremely unsatisfactory, particularly in the severer forms. The slight catarrhal cases require no special treatment. When the dysphagia is intense it is best not to give food by the mouth, but to feed entirely by enemata. Fragments of ice may be given, and as the pain and distress subside, demulcent drinks. External applications of cold often give relief.

A *chronic* form of œsophagitis is described, but it results usually from the prolonged action of the causes which produce the acute form.

Associated with chronic heart disease and more frequently with the senile and the cirrhotic liver, the œsophageal veins may be enormously distended and varicose, particularly toward the stomach. In these cases the mucous membrane is in a state of chronic catarrh, and the patient has frequent eructations of mucus. Rupture of these œsophageal veins may cause fatal hæmorrhage. Two cases of the kind have occurred in my experience.

II. SPASM OF THE ŒSOPHAGUS (*Œsophagismus*).

This so-called spasmodic stricture of the gullet is met with in hysterical patients and hypochondriacs, also in chorea, epilepsy, and especially hydrophobia. It is sometimes associated also with the lodgment of foreign bodies. The idiopathic form is found in females of a marked neurotic habit, but may also occur in elderly men. It may be present only during pregnancy. Of three cases which have come under my observation, two were in men, one a hypochondriac over sixty years of age who for many months had taken only liquid food, and with great difficulty, owing to a spasm which accompanied every attempt to swallow. The readiness with which the bougie passed and the subsequent history showed the true nature of the case. The patient complains of inability to

swallow solid food, and in extreme instances even liquids are rejected. The attack may come on abruptly, and be associated with emotional disturbances and with substernal pain. The bougie, when passed, may be arrested temporarily at the seat of the spasm, which gradually yields, or it may slip through without the slightest effort. The condition is rarely serious. Death has however followed.

The *diagnosis* is not difficult, particularly in young persons with marked nervous manifestations. In elderly persons œsophagismus is almost always connected with hypochondriasis, but great care must be taken to exclude cancer.

In some cases a cure is at once effected by the passage of a bougie. The general neurotic condition also requires special attention.

Paralysis of the œsophagus scarcely demands separate consideration. It is a very rare condition, due most often to central disease, particularly bulbar paralysis. It may be peripheral in origin as in diphtheritic paralysis. Occasionally it occurs also in hysteria. The essential symptom is dysphagia.

III. STRICTURE OF THE ŒSOPHAGUS.

This results from : (*a*) Congenital narrowing. (*b*) The cicatricial contraction of healed ulcers, usually due to corrosive poisons, occasionally to syphilis. (*c*) The growth of tumors in the walls, as in the so-called cancerous stricture. Occasionally polypoid tumors projecting from the mucosa produce great narrowing. (*d*) External pressure by aneurism, enlarged lymph glands, enlarged thyroid, other tumors, and sometimes by pericardial effusion.

The cicatricial stricture may occur anywhere in the gullet, and in extreme cases may, indeed, involve the whole tube, but in a majority of instances it is found either high up near the pharynx or low down toward the stomach. The narrowing may be extreme, so that only small quantities of food can trickle through, or the obstruction may be quite slight. There is usually no difficulty in making a diagnosis of the cicatricial stricture, as the history of mechanical injury or the swallowing of a corrosive fluid makes clear the nature of the case. When the stricture is low down the œsophagus is dilated and the walls are usually much hypertrophied. When it is high in the gullet the food is usually rejected at once, whereas if low it may be retained and a considerable quantity collects before it is regurgitated. Any doubt as to its having reached the stomach is removed by the alkalinity of the materials ejected and the absence of the characteristic gastric odor. Auscultation of the œsophagus may be practised and is sometimes of service. The patient takes a mouthful of water and the auscultator listens along the left of the spine. During deglutition at the seat of the stricture, in place of the normal œsophageal *bruit*, there will be

heard a loud splashing, gurgling sound. The passage of the œsophageal bougie will determine more accurately the locality. Conical bougies attached to a flexible whalebone stem are the most satisfactory, but the gum-elastic stomach tube may be used; a large one should be tried first. The patient should be placed on a low chair with the head well thrown back. The index finger of the left hand is passed far into the pharynx, and in some instances this procedure alone may determine the presence of a new growth. The bougie is passed beside the finger until it touches the posterior wall of the pharynx, then along it, more to one side than in the middle line, and so gradually pushed into the gullet. It is to be borne in mind that in passing the cricoid cartilage there is often a slight obstruction. Great gentleness should be used, as it has happened more than once that the bougie has been passed through a cancerous ulcer into the mediastinum or through a diverticulum. I have known this accident to happen twice—once in the case of a distinguished surgeon, who performed œsophagotomy and passed the tube, as he thought, into the stomach. The post-mortem on the next day showed that the tube had entered a diverticulum and through it the left pleura, in which the milk injected through the tube was found. In the other instance the tube passed through a cancerous ulcer into the lung, which was adherent and inflamed. Fortunately these accidents, sometimes unavoidable, are extremely rare. It is well always, as a precautionary measure before passing the bougie, to examine carefully for aneurism, which may produce all the symptoms of organic stricture. In cases in which the stricture is extreme there is always emaciation.

The prognosis in these cases is good so long as the stricture is dilatable. The persistent treatment of cicatricial stricture by gradual dilatation is very beneficial, and patients improve remarkably under this method. When extreme, the treatment by bougie is not possible, and the question of œsophagotomy or gastrotomy must be considered. Rectal alimentation should be employed whenever the patient is unable to take sufficient food by the mouth.

IV. CANCER OF THE ŒSOPHAGUS.

This is usually epithelioma. It is not an uncommon disease, and occurs more frequently in males than in females. The common situation is in the upper third of the tube. At first confined to the mucous membrane, the cancer gradually increases and soon ulcerates. The lumen of the tube is narrowed, but when ulceration is extensive in the later stages the stricture may be less marked. Dilatation of the tube and hypertrophy of the walls usually take place above the cancer. The cancerous ulcer may perforate the trachea or a bronchus, the lung, the mediastinum, the aorta or one of its larger branches, the pericardium, or it may erode the

vertebral column. In my experience perforation of the lung has been the most frequent, producing, as a rule, local gangrene.

Symptoms.—The earliest symptom is dysphagia, which is progressive and may become extreme, so that the patient emaciates rapidly. Regurgitation may take place at once; or, if the cancer is situated near the stomach, it may be deferred for ten or fifteen minutes, or even longer if the tube is much dilated. The rejected materials may be mixed with blood and may contain cancerous fragments. In persons over fifty years of age persistent difficulty in swallowing accompanied by rapid emaciation usually indicates œsophageal cancer. The cervical lymph glands are frequently enlarged and may give early indication of the nature of the trouble. Pain may be persistent or is present only when food is taken. In certain instances the pain is very great. I saw an autopsy on a case of cancer of the œsophagus in which the patient gradually became emaciated, but had no special symptoms to call attention to the disease. These latent cases are, however, very rare.

The *prognosis* is hopeless, and the patients usually become progressively emaciated, and die either of asthenia or sudden perforation of the ulcer.

In the *diagnosis* of the condition it is important, in the first place, to exclude pressure from without, as by aneurism or other tumor. The history enables us to exclude cicatricial stricture and foreign bodies. The sound may be passed and the presence of the stricture determined. As mentioned above, great care should be exercised.

Treatment.—In most cases milk and liquids can be swallowed, but supplementary nourishment should be given by the rectum. It may be advisable in some instances to pass a tube into the stomach and attempt to feed in this way. If the patient is willing to take the risk, œsophagotomy or gastrotomy may be performed in order to prolong life.

V. RUPTURE OF THE ŒSOPHAGUS.

This may occur in a healthy organ as a result of prolonged vomiting. Boerhaave described the first case in Baron Wassennar, who "broke asunder the tube of the œsophagus near the diaphragm, so that, after the most excruciating pain, the elements which he swallowed passed, together with the air, into the cavity of the thorax, and he expired in twenty-four hours." Fitz has reported a case and has analyzed the literature on the subject up to 1877. The accident has usually occurred during vomiting after a full meal or when intoxicated. It is, of course, invariably fatal.

Much more common is the post-mortem digestion of the œsophagus, which was first described by King, of Guy's Hospital. It is not very infrequent. In one instance I found the contents of the stomach in the left pleura. The erosion is in the posterior wall, and may be of considerable extent.

VI. DILATATIONS AND DIVERTICULA.

Stenosis of the gullet is followed by secondary dilatation of the tube above the constriction and great hypertrophy of the walls. Primary dilatation is extremely rare. The tube may attain extraordinary dimensions—30 cm. in circumference in Luschka's case. Regurgitation of food is the most common symptom. There may also be difficulty in breathing from pressure.

Diverticula are of two forms: (*a*) Pressure diverticula, which are most common at the junction of the pharynx and gullet, on the posterior wall. Owing to weakness of the muscles at this spot, local bulging occurs, which is gradually increased by the pressure of food, and finally forms a saccular pouch. (*b*) The traction diverticula situated on the anterior wall near the bifurcation of the trachea, result, as a rule, from the extension of inflammation from the lymph glands with adhesion and subsequent cicatricial contraction, by which the wall of the gullet is drawn out.

VI. DISEASES OF THE STOMACH.

I. METHODS OF CLINICAL EXAMINATION.

The stomach normally occupies the left upper quadrant of the abdomen, one quarter of the organ only lying to the right of the median line; it is bordered above by the diaphragm and liver, below by the intestine and transverse colon; on the left it reaches the spleen, and on the right it touches the gall-bladder; anteriorly it lies against the ribs and the abdominal wall. The longitudinal axis extends from the left above downward and backward to the right.

The cardiac orifice is about opposite the sternal border of the sixth or seventh left costal cartilage. The highest point of the fundus reaches the level of the fifth rib, or even that of the fourth interspace, while the lowest point is 3 or 4 cm. above the navel. The pylorus lies on a level with the tip of the xiphoid cartilage at a point midway between the right sternal and parasternal lines; it is normally covered by the left lobe of the liver. With the stomach moderately filled with air the upper limit of resonance reaches the fifth interspace in the left mammary line, while the lower limit is several cm. above the navel.

The greatest vertical diameter of gastric resonance varies, according to Pacanowski, from 10 to 14 cm. in the male, and is about 10 cm. in the female.

Methods for determining the Position and Size of the Stomach.—(1) Inflation by bicarbonate of soda and tartaric acid. Dissolve a teaspoonful of each separately in as small a quantity of water as possible,

a diverticulum of the oesophagus has been successfully operated by von Bergmann

VII Fistula of oesophagus.

VIII ulcer of oesophagus. see Gunteras case. probably peptic

and let the patient drink the one solution immediately after the other.

(2) Inflation by means of a bulb-syringe apparatus which can be attached to a stomach tube already introduced.

(3) As a makeshift the patient may be given 250 to 500 c. c. of water on an empty stomach in divided doses and the lower limit of the stomach determined by percussion after each drink. The normal stomach sinks gradually to a point a little above the navel, while the dilated and atonic stomach falls rapidly to a much lower level.

The first method is the simplest and most practical, and is generally one of the first steps in the physical examination; the tube is not introduced until the test-meal has been given. The method has the objection that the amount of air introduced cannot be so well regulated and that one may not in a given case fill the stomach to the entire capacity, while occasionally a spasmodic contraction of the cardia and pylorus may give the patient for a time some discomfort.

Auscultation of the Deglutatory Murmurs.—On listening at the tip of the xiphoid cartilage as the patient swallows a mouthful of water one hears normally two murmurs. (1) The primary murmur is heard synchronously with the act of deglutition and sounds as if water were injected into a space containing air. (2) The secondary murmur is heard up to twelve seconds later and is a coarser gurgling sound. It is well while listening to place one hand on the trachea, as the first murmur may be absent. In œsophageal and cardiac stenosis the second sound is delayed and altered in character.

The following description of methods is merely a rough summary. For fuller particulars see the works of Ewald, Boas, Leo, Wesener, etc.

Examination of the Contents of the Stomach.—Various forms of test-meals have been proposed. The simplest and most satisfactory is that of Ewald. His test breakfast (*Probefrühstück*) consists of one roll (*Brödchen*)—about thirty grammes of white bread—and one glass of water or a cup of tea without milk or sugar. One hour later the contents are to be expressed.

The contents should not be more than 20 to 40 c. c. The filtrate should be a clear yellow or yellowish-brown fluid. The fluid should contain free hydrochloric acid; it should not contain sufficient lactic acid to be recognized by the ordinary tests. Pepsin and pepsinogen, the curdling ferment and its zymogen, should be present.

Albuminoids should be almost entirely converted into peptones; propeptones, if present at all, should be recognizable only in traces. Starches should be so far converted into achroödextrin, dextrose, or maltose that the reaction for starch or erythrodextrin with Lugol's solution should be no longer present.

Chemical Examination of the Gastric Contents.

(1) *Acidity* may be determined by litmus paper.

(2) *Presence of Free Acid.*—(*a*) Tropæolin O. O. The brownish-yellow color of the alcoholic solution is turned by the addition of a fluid containing free acid to a deep mahogany brown or brown-red or deep red, according to the strength of the acid. This is most commonly used as tropæolin paper—strips of filter paper soaked for some time in an alcoholic solution. The paper must not be kept too long. It is best to make up a new quantity monthly at least.

(*b*) Congo red. Solutions of Congo red of a brick-red color are turned blue by the addition of a fluid containing pure acid. This is best used as Congo paper, which is a very delicate reagent, and, on the whole, the most satisfactory. Many other reagents have been used (methyl violet, fuchsin, malachite green, benzopurpurin), but the two above-mentioned tests are probably as satisfactory as any.

(3) *Presence of Free HCl.*—The best and simplest test is that of Günzburg: Phloroglucin, 2; vanillin, 1; absolute alcohol, 30. To a drop of the gastric contents (better filtered) add a similar quantity of the reagent on a porcelain plate. On evaporation gradually to dryness over a flame, a beautiful rose-red color begins to appear at the edges if HCl is present. This is merely a test for a free mineral acid, but HCl is the only one present in the gastric juice.

(4) *Presence of Lactic Acid.*—The best test is that of Uffelmann. Add 1 to 2 drops of tinctura ferri chloridi to 10 to 20 c. c. of a 5-per-cent solution of carbolic acid and dilute with water till it assumes an amethyst-blue color. On the addition of a few drops of a solution containing lactic acid to about 1 c. c. of this solution the color changes to a clear lemon-yellow. The test may be simulated in the presence of phosphates, mineral acids in concentration, grape sugar, alcohol, etc.; hence in cases of doubt it is always prudent to shake 20 c. c. of gastric juice with 10 c. c. of ether three times and then evaporate the ether to dryness over a water bath. To the ether residue, which contains any lactic acid present, add several drops of water. On the addition to this of an equal quantity of the reagent a reliable test for lactic acid may be obtained.

(5) *Butyric acid* gives with Uffelmann's reagent a result very similar to that with lactic acid. The color is, however, more brownish. The odor is sufficient evidence of its presence for practical purposes, which is also true of

(6) *Acetic Acid.*

Quantitative Tests.—(*a*) Test for the total acidity. This test is practically a test for the HCl, where this is present to any extent, as, under these circumstances, other acids are present usually in unappreciable quantities. To 5 to 10 c. c. of filtered gastric contents, a one-tenth normal solution of sodic hydrate is added from a burette till neutralization. This point can be determined by adding a drop of an alcoholic solution of phenolphthalein to the gastric juice. The solution remains colorless in acid or neutral solution, but turns red in alkaline. This test estimates not only the

free HCl, but that in combination. Normally 4 to 6 to 6·5 of the one-tenth solution is required. Each c. c. of this one-tenth solution = ·003646 HCl.

(*b*) *Test for Free HCl.*—If one desires to estimate more accurately the free HCl, the simplest method is Boas's modification of that of Mintz. From 10 c. c. of the gastric contents all organic acids are removed by shaking with 100 c. c. of ether, and then the test performed as above until Congo shows no longer a grayish-blue discoloration.

Quantitative tests for organic acids are complicated and in practice unnecessary.

Tests for Pepsin and Curdling Ferment and their Zymogens.—In the presence of free HCl it is unnecessary to examine for these elements, as they may be safely assumed to be present.

(1) *Test for Pepsin and Pepsinogen.*—(*a*) In presence of HCl the presence of pepsin may be determined by adding to 5 to 10 c. c. of the gastric contents a small piece of egg albumen and observing digestion at 37° to 40° during several hours.

(*b*) In the absence of HCl, pepsinogen alone is found. Add to 10 c. c. of the filtered gastric contents 1 to 2 drops of a 25 per cent HCl solution; add, as before, a small shaving of egg albumen, and see if it is dissolved. The HCl turns the pepsinogen into pepsin.

(2) *Test for the Curdling Ferment and its Zymogen.*—(*a*) Test for the curdling ferment. Neutralize exactly 5 to 10 c. c. of the filtered gastric contents with one tenth normal NaOH solution and mix with an equal quantity of neutral or amphoteric milk. If the ferment is present curdling will occur in from ten to fifteen minutes at 37° to 40°. One may proceed more simply by adding 3 to 5 drops of the filtered gastric juice to 10 c. c. of milk, when curdling will occur as above.

(*b*) Test for the zymogen. To 10 c. c. of filtered gastric juice add CaO_2H_2 till slightly alkaline. This sets the zymogen free, and, on mixing with an equal quantity of milk, coagulation will occur as above.

These tests are of much value in the absence of HCl to determine the condition of the mucous membrane. For HCl alone may be absent for a greater or less length of time from various nervous causes, while the absence of pepsin and its curdling ferment at the same time would suggest a serious impairment of the secretory functions.

Tests for the condition of the albuminoids in digestion are complicated, and not necessary in an ordinary clinical examination (directions can be found in the books of Ewald, Boas, Leo, von Jacksch, Wesener, etc.).

Tests for the Condition of the Starch.—If, after an hour of digestion, the addition of a drop of Lugol's solution to the filtered gastric juice is followed by the reaction for starch (blue) or erythrodextrin (purple), we may know that the digestion of starch has been hindered. This is usually due to a hyperacidity.

Tests for the Motive Power of the Stomach.—There are various methods, but practically perfectly good results can be obtained by observation

of the amount of fluid obtained after a test breakfast. More than 40 c. c. is a sure indication of motor insufficiency. Large quantities are always suggestive of dilatation.

Test for the Absorptive Power of the Stomach.—Kali iodidi (pure), 0·2 gramme, is taken in a perfectly clean capsule when the stomach is empty. The sputa, tested every two or three minutes with starch and HNO_3, give the blue reaction inside of fifteen minutes in normal cases. The conclusions to be drawn from this test are, however, of little value.

II. ACUTE GASTRITIS

(Simple Gastritis; Acute Gastric Catarrh; Acute Dyspepsia).

Etiology.—Acute gastric catarrh, one of the most common of complaints, occurs at all ages, and is usually traceable to errors in diet. It may follow the ingestion of more food than the stomach can digest, or it may result from taking unsuitable articles, which either themselves irritate the mucosa or, remaining undigested, decompose, and so excite an acute dyspepsia. A frequent cause is the taking of food which has begun to decompose, particularly in hot weather. In children these fermentative processes are very apt to excite acute catarrh of the bowels as well. Another very common cause is the abuse of alcohol, and the acute gastritis which follows a drinking-bout is one of the most typical forms of the disease. The tendency to acute indigestion varies very much in different individuals, and indeed in families. We recognize this in using the expressions a "delicate stomach" and a "strong stomach." Gouty persons are generally thought to be more disposed to acute dyspepsia than others. Acute catarrh of the stomach occurs at the outset of many of the infectious fevers.

Lebert described a special infectious form of gastric catarrh, occurring in epidemic form, and only to be distinguished from mild typhoid fever by the absence of rose spots and swelling of the spleen. Many practitioners still adhere to the belief that there is a form of *gastric fever*, but the evidence of its existence is by no means satisfactory, and certainly a great majority of all cases in this country are examples of mild typhoid.

Morbid Anatomy.—Beaumont's study of St. Martin's stomach showed that in acute catarrh the mucous membrane is reddened and swollen, less gastric juice is secreted, and mucus covers the surface. Slight hæmorrhages may occur or even small erosions. The submucosa may be somewhat œdematous. Microscopically the changes are chiefly noticeable in the mucous and peptic cells, which are swollen and more granular, and there is an infiltration of the intertubular tissue with leucocytes.

Symptoms.—In mild cases the symptoms are those of slight "indigestion"—uncomfortable feeling in the abdomen, headache, depression,

nausea, eructations, and vomiting, which usually gives relief. The tongue is heavily coated and the saliva is increased. In children, there are intestinal symptoms—diarrhœa and colicky pains. The pulse may be slightly increased, but in some instances is less frequent than normal; there is usually no fever. The duration is rarely more than twenty-four hours. In the severer forms the attack may set in with a chill and febrile reaction, in which the temperature rises to 102° or 103°. The tongue is furred, the breath heavy, and vomiting is frequent. The ejected substances, at first mixed with food, subsequently contain much mucus and bile-stained fluids. There may be constipation, but very often there is diarrhœa. The urine presents the usual febrile characteristics, and there is a heavy deposit of urates. The abdomen may be somewhat distended and slightly tender in the epigastric region. Herpes may appear on the lips. The attack may last from one to three days, and occasionally longer. The examination of the vomitus shows, as a rule, absence of the hydrochloric acid, presence of lactic and fatty acids, and marked increase in the mucus.

Diagnosis.—The ordinary afebrile gastric catarrh is readily recognized. The acute febrile form is so similar to the initial symptoms of many of the infectious diseases that it is impossible for a day or two to make a definite diagnosis, particularly in the cases which have come on, so to speak, spontaneously and independently of an error in diet. Some of these resemble closely an acute infection; the symptoms may be very intense, and if, as sometimes happens, the attack sets in with severe headache and delirium the case may be mistaken for meningitis. When the abdominal pains are intense the attack may be confounded with gall-stone colic. In discriminating between acute febrile gastritis and the abortive forms of typhoid fever it is to be borne in mind that in the former the temperature rises abruptly, the remissions are slighter, and the drop is more sudden. The initial bronchitis, the well-marked splenic enlargement, and the rose spots are not present. It is a very common error to class under gastric fever the mild forms of the various infectious disorders.

Treatment.—Mild cases recover spontaneously in twenty-four hours, and require no treatment other than a dose of castor oil in children or of blue mass in adults. In the severer forms, if there is much distress in the region of the stomach, the vomiting should be promoted by warm water or the simple emetics. A full dose of calomel, eight to ten grains, should be given, and followed the next morning by a dose of Hunyadi-Janos or Carlsbad water. If there is eructation of acid fluid, bicarbonate of soda and bismuth may be given. The stomach should have, if possible, absolute rest, and it is a good plan in the case of strong persons, particularly in those addicted to alcohol, to cut off all food for a day or two. The patient may be allowed soda water and ice freely. It is well not to attempt to check the vomiting unless it is excessive and protracted. Recovery is

usually complete, though repeated attacks may lead to subacute gastritis or to the establishment of chronic dyspepsia.

Phlegmonous Gastritis; Acute Suppurative Gastritis.—This is an excessively rare disease, characterized by the occurrence of suppurative processes in the submucosa. The affection is more common in men than in women. The cause is seldom obvious. It has been met with as an idiopathic affection, but it has occurred also in puerperal fever and other septic processes, and has occasionally followed trauma. Anatomically there appear to be two forms, a diffuse purulent infiltration and a localized abscess formation, in which case the tumor may reach the size of an egg, and may burst into the stomach or into the peritoneal cavity.

The *symptoms* are variable. There are usually pain in the abdomen, fever, dry tongue, and symptoms of a severe infective process, delirium and coma preceding death. Jaundice has been met with in some instances. Occasionally, when the abscess tumor is large, it has been felt externally, in one case forming a mass as large as two fists. There are instances which run a more chronic course, with pains in the abdomen, fever, and chills.

The *diagnosis* is rarely possible, even when with abscess rupture occurs, and the pus is vomited, as it is not possible to differentiate this condition from an abscess perforating into the stomach from without. It is stated, however, that Chvostek made the diagnosis in one of his cases.

Toxic Gastritis.—This most intense form of inflammation of the stomach is excited by the swallowing of concentrated mineral acids or strong alkalies, or by such poisons as phosphorus, corrosive sublimate, ammonia, arsenic, etc. In the non-corrosive poisons, such as phosphorus, arsenic, and antimony, the process consists of an acute degeneration of the glandular elements, and hæmorrhage. In the powerful concentrated poisons the mucous membrane is extensively destroyed, and may be converted into a brownish-black eschar. In the less severe grades there may be areas of necrosis surrounded by inflammatory reaction, while the submucosa is hæmorrhagic and infiltrated. The process is of course more intense at the fundus, but the active peristalsis may drive the poison through the pylorus into the intestine.

The *symptoms* are intense pain in the mouth, throat, and stomach, salivation, great difficulty in swallowing, and constant vomiting, the vomited materials being bloody and sometimes containing portions of the mucous membrane. The abdomen is tender, distended, and painful on pressure. In the most acute cases symptoms of collapse supervene; the pulse is weak, the skin pale and covered with sweat; there is restlessness, and sometimes convulsions. There may be albumen or blood in the urine, and petechiæ may develop on the skin. When the poison is less intense, the sloughs may separate, leaving ulcers, which too often lead, in the œsophagus, to stricture, and in the stomach to chronic atrophy, and finally to death from exhaustion.

ulcers, as in a case of John Thomson's, the membranes are vomited

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The *diagnosis* of toxic gastritis is usually easy, as inspection of the mouth and pharynx shows, in many instances, corrosive effects, while the examination of the vomit may indicate the nature of the poison.

In poisoning by acids, magnesia should be administered in milk or with egg albumen. When strong alkalies have been taken, the dilute acids should be administered. For the severe inflammation which follows the swallowing of the stronger poisons palliative treatment is alone available, and morphia may be freely employed to allay the pain.

Diphtheritic or Membranous Gastritis.—This condition is met with occasionally in diphtheria, but more commonly as a secondary process in typhus or typhoid fever, pneumonia, pyæmia, small-pox, and occasionally in debilitated children. An instance of it came under my notice in pneumonia. The exudation may be extensive and uniform or in patches. The condition is not recognizable during life.

Mycotic and Parasitic Gastritis.—It occasionally happens that fungi develop in the stomach and excite inflammation. One of the most remarkable cases of the kind is that reported by Kundrat, in which the favus fungus developed in the stomach and intestine.

In cancer and in dilatation of the stomach the sarcinæ and yeast fungi probably aid in maintaining the chronic gastritis. As a rule, the gastric juice is capable of killing the ordinary bacteria. Orth states that the anthrax bacilli, in certain cases, produce swelling of the mucosa and ulceration. Klebs has described a *bacillus gastricus* which develops in the tubules and produces numerous spores, and Eug. Fraenkel has reported a case of acute emphysematous gastritis probably of mycotic origin. The larvæ of certain insects may excite gastritis, as in the cases reported by Gerhardt, Meschede, and others. In rare instances tuberculosis and syphilis attack the gastric mucosa.

III. CHRONIC GASTRITIS

(*Chronic Catarrh of the Stomach; Chronic Dyspepsia*).

Definition.—A condition of disturbed digestion associated with increased mucus formation, qualitative or quantitative changes in the gastric juice, enfeeblement of the muscular coats, so that the food is retained for an abnormal time in the stomach; and, finally, with alterations in the structure of the mucosa.

Etiology.—The causes of chronic gastritis may be classified as follows: (1) Dietetic. The use of unsuitable or improperly prepared food. The persistent use of certain articles of diet, such as very fat substances or foods containing too much of the carbohydrates. The use in excess of tea or coffee, and, above all, alcohol in its various forms. Under this heading, too, may be mentioned the habits of eating at irregular hours or too rapidly and imperfectly chewing the food. A common cause of chronic

catarrh is drinking too freely of ice-water during meals, a practice which plays no small part in the prevalence of dyspepsia in America. Another frequent cause is the abuse of tobacco. (2) Constitutional causes. Anæmia, chlorosis, chronic tuberculosis, gout, diabetes, and Bright's disease are often associated with chronic gastric catarrh. (3) Local conditions: (*a*) of the stomach, as in cancer, ulcer and dilatation, which are invariably accompanied by catarrh; (*b*) conditions of the portal circulation, causing chronic engorgement of the mucous membrane, as in cirrhosis, chronic heart disease, and certain chronic lung affections.

Morbid Anatomy.—Anatomically two forms of chronic gastritis may be recognized, the simple and the sclerotic.

(*a*) **Simple Chronic Gastritis.**—The organ is usually enlarged, the mucous membrane pale gray in color, and covered with closely adherent, tenacious mucus. The veins are large, patches of ecchymosis are not infrequently seen, and in the chronic catarrh of portal obstruction and of chronic heart disease small hæmorrhagic erosions. Toward the pylorus the mucosa is not infrequently irregularly pigmented, and presents a rough, wrinkled, mammillated surface, the *état mammeloné* of the French, a condition which may sometimes be so prominent that writers have described it as *gastritis polyposa*. The membrane may be thinner than normal, and much firmer, tearing less readily with the finger-nail. Ewald thus describes the histological changes: The minute anatomy shows the picture of a parenchymatous and an interstitial inflammation. The gland cells are in part eroded or show cloudy granular swelling or atrophy. The distinction between the "haupt" and "beleg" cells cannot be recognized, and in many places, particularly in the pyloric region, the tubes have lost their regular form and show in many places an atypical branching, like the fingers of a glove. Individual glands are cut off toward the fundus, but appear at the border of the submucosa as cysts, partly empty, with a smooth membrane, partly filled with remnants of hyaline and refractile epithelium. An abundant small-celled infiltration presses apart the tubules and is particularly marked toward the surface of the mucosa, and from the submucosa extensions of the connective tissue may be seen passing between the glands. The mucoid transformation of the cells of the tubules is a striking feature in the process and may extend to the very fundus of the glands.

(*b*) **Sclerotic Gastritis.**—As a final result of the parenchymatous and interstitial changes the mucous membrane may undergo complete atrophy, so that but few traces of secreting substance remain. There appear to be two forms of this sclerotic atrophy—one with thinning of the coats of the stomach, *phthisis ventriculi*, and a retention or even increase of the size of the organ; the other with enormous thickening of the coats and great reduction in the volume of the organ, the condition which is usually described as *cirrhosis ventriculi*. Extreme atrophy of the mucous membrane of the stomach has been carefully studied by Fenwick,

Ewald, and others, and we now recognize the fact that there may be such destruction and degeneration of the glandular elements by a progressive development of interstitial tissue that ultimately scarcely a trace of secreting tissue remains. In a characteristic case, studied by Henry and myself,* the greater portion of the lining membrane of the stomach was converted into a perfectly smooth, cuticular structure, showing no trace whatever of glandular elements, with enormous hypertrophy of the muscularis mucosæ, and here and there formation of cysts. In the other form, with identical atrophy and cyst formation, there is enormous increase in the connective tissue, and the stomach may be so contracted that it does not hold more than a couple of ounces. The walls may measure from two to three centimetres; the greatest increase in thickness is in the submucosa, but the hypertrophy also extends to the muscular layers. While one is not justified in saying that all cases of cirrhosis of the stomach represent a final stage in the history of a chronic catarrh, it is true that in most cases the process is associated with atrophy of the gastric mucosa, while the history indicates the existence of chronic dyspepsia.

Symptoms.—The affection persists for an indefinite period, and, as is the case with most chronic diseases, changes from time to time. The appetite is variable, sometimes greatly impaired, at others very good. Among early symptoms are feelings of distress or oppression after eating, which may become aggravated and amount to actual pain. When the stomach is empty there may also be a painful feeling. The pain differs in different cases, and may be trifling or of extreme severity. When localized and felt beneath the sternum or in the præcordial region it is known as heart-burn or sometimes cardialgia. There is pain on pressure over the stomach, usually diffuse and not severe. The tongue is coated, and the patient complains of a bad taste in the mouth. The tip and margin of the tongue are very often red. Associated with this catarrhal stomatitis there may be an increase in the salivary and pharyngeal secretions. Nausea is an early symptom, and is particularly apt to occur in the morning hours. It is not, however, nearly so constant a symptom in chronic gastritis as in cancer of the stomach, and in mild grades of the affection it may not occur at all. Eructation of gas, which may continue for some hours after taking food, is a very prominent feature in cases of so-called flatulent dyspepsia, and there may be marked distension of the intestines. With the gas, bitter fluids may be brought up. In other instances a clear watery fluid is ejected (pyrosis or water-brash). The vomiting does not often occur when the stomach is empty, but either immediately after eating or an hour or two later. The vomitus consists of food in various stages of digestion and slimy mucus, and the chemical examination shows the presence of abnormal acids, such as butyric, or even acetic, in addition to lactic acid, while the hydrochloric acid, if indeed it is present,

* American Journal of the Medical Sciences, 1886.

is much reduced in quantity. The digestion may be much delayed, and on washing out the stomach as late as seven hours after eating, portions of food are still present. The prolonged retention favors decomposition, the stomach becomes distended with gas, and this, with the chronic catarrh, may induce gradually an atony of the muscular walls. The absorption is slow, and iodide of potassium, given in capsules, which should normally reach the saliva within fifteen minutes, may not be evident for more than half an hour.

Constipation is usually present, but in some instances there is diarrhœa, and undigested food passes rapidly through the bowels. The urine is often scanty, high-colored, and deposits a heavy sediment of urates.

Of other symptoms headache is common, and the patient feels constantly out of sorts, indisposed for exertion, and low-spirited. In aggravated cases melancholia may develop. Trousseau called attention to the occurrence of vertigo, a marked feature in certain cases. The pulse is small, sometimes slow, and there may be palpitation of the heart. Fever does not occur. Cough is sometimes present, but the so-called stomach cough of chronic dyspeptics is in all probability dependent upon pharyngeal irritation.

The symptoms of atrophy of the mucous membrane of the stomach, with or without contraction of the organ, are very complex, and cannot be said to present a uniform picture. The majority of the cases present the symptoms of an aggravated chronic dyspepsia, often of such severity that cancer is suspected. In one of the cases which I examined the persistent distress after eating, the vomiting, and the gradual loss of flesh and strength, very naturally led to this diagnosis, but the duration of the disease far exceeded that of ordinary carcinoma. In the cirrhotic form the tumor mass may sometimes be felt. In atrophy of the stomach, whether associated with cirrhosis or not, the clinical picture may be that of pernicious anæmia. As early as 1860, Flint called attention to this connection between atrophy of the gastric tubules and anæmia, an observation which Fenwick and others have amply confirmed.

Diagnosis.—The use of the stomach-tube and the chemical examination of the contents of the stomach obtained in this way have given us special information with reference to the various forms of gastritis and the modes of differentiating them. The soft-rubber stomach-tube, provided with a funnel-shaped dilatation, is the most satisfactory to use, as it is very readily passed, and if used by the patient is not likely to cause damage. It should be open at the end and possess one or two lateral openings.

Ewald distinguishes three forms of chronic gastritis: (1) Simple gastritis; (2) mucous (*schleimige*) gastritis; (3) atrophy.

In (1) the fasting stomach contains only a small quantity of a slimy fluid, while after the test breakfast the HCl is diminished in quantity and lactic acid and the fat acids are usually present.

In (2) the acidity is always slight and the condition is distinguished from (1) chiefly by the large amount of mucus present.

In (3) the fasting stomach is generally empty, while after the test breakfast HCl, pepsin, and the curdling ferment are wholly wanting.

Treatment.—When possible the cause in each case should be ascertained and an attempt made to determine the special form of indigestion. Usually there is no difficulty in differentiating the ordinary catarrhal and the nervous varieties. A careful study of the phenomena of digestion in the way already laid down, though not essential in every instance, should certainly be carried out in the more obstinate and obscure forms. Two important questions should be asked of every dyspeptic—first, as to the time taken at his meals; and, second, as to the quantity he eats. Practically a large majority of all cases of disturbed digestion come from hasty and imperfect mastication of the food and from overeating. Especial stress should be laid upon the former point. In some instances it will alone suffice to cure dyspepsia if the patient will count a certain number before swallowing each mouthful. The second point is of even greater importance. People habitually eat too much, and it is probably true that a greater number of maladies arise from excess in eating than from excess in drinking. Particularly is this the case in America, where the average man is abstemious in the matter of alcohol, but imprudent to a degree in all matters relating to food. Moreover, people have not had time to learn the art of cooking, and much of the indigestion, particularly in the country districts, may be charged to the barbarous methods of preparing the food. The treatment may be considered under the headings of dietetic and medicinal.

(*a*) *General and Dietetic.*—A careful and systematically arranged dietary is the first, sometimes the only essential in the treatment of a case of chronic dyspepsia. It is impossible to lay down rules applicable to all cases. Individuals differ extraordinarily in their capability of digesting different articles of food, and there is much truth in the old adage, "One man's food is another man's poison." The individual preferences for different articles of food should be permitted in the milder forms. Physicians have probably been too arbitrary in this direction, and have not yielded sufficiently to the intimations given by the appetite and desires of the patient.

A rigid milk diet may be tried in obstinate cases. Much depends upon whether the patient is able to take and digest milk properly. In the forms associated with Bright's disease and chronic portal congestion, as well as in many instances in which the dyspepsia is part of a neurasthenic or hysterical trouble, this plan in conjunction with rest is most efficacious. If milk is not digested well it may be diluted one third with soda water or Vichy, or five to ten grains of carbonate of soda, or a pinch of salt may be added to each tumblerful. In many cases the milk from which the cream has been taken is better borne. Buttermilk is particularly

suitable, but can rarely be taken for as long a time alone, as patients tire of it much more readily than they do of ordinary milk. Not only can the general nutrition be maintained on this diet, but patients sometimes increase in weight, and the unpleasant gastric symptoms disappear entirely. It should be given at fixed hours and in definite quantities. A patient may take six or eight ounces every three hours. The amount necessary varies a good deal, but at least three to five pints should be given in the twenty-four hours. This form of diet is not, as a rule, well borne when there is a tendency to dilatation of the stomach. The milk may be previously peptonized, but it is impossible to feed a chronic dyspeptic in this way. The stools should be carefully watched, and if more milk is taken than can be digested it is well to supplement the diet with eggs and dry toast or biscuits.

In a large proportion of the cases of chronic indigestion it is not necessary to annoy the patient with such strict dietaries. It may be quite sufficient to cut off certain articles of food. Thus, if there are acid eructations or flatulency, the farinaceous foods should be restricted, particularly potatoes and the coarser vegetables. A fruitful source of indigestion is the hot bread which, in different forms, is regarded as an essential part of an American breakfast. This, as well as the various forms of pancakes, pies and tarts, with heavy pastry, and fried articles of all sorts, should be strictly forbidden. As a rule, white bread, toasted, is more readily digested than bread made from the whole meal. Persons, however, differ very much in this respect, and the Graham or brown bread is for many people most digestible. Sugar and very sweet articles of food should be taken in great moderation or avoided altogether by persons with chronic dyspepsia. Many instances of aggravated indigestion have come to my notice due to the prevalent practice of eating largely of ice-cream. One of the most powerful enemies of the American stomach in the present day is the soda-water fountain, which has usurped so important a place in the apothecary shop.

Fats, with the exception of a moderate amount of good butter, very fat meats, and thick, greasy soups should be avoided. Ripe fruit in moderation is often advantageous, particularly when cooked. Bananas are not, as a rule, well borne. Strawberries are to many persons a cause of an annual attack of indigestion and sore throat in the spring months.

As stated, in the matter of special articles of food it is impossible to lay down rigid rules, and it is the common experience that one patient with indigestion will take with impunity the very articles which cause the greatest distress to another.

Another detail of importance which may be mentioned in this connection is the general hygienic management of dyspeptics. These patients are often introspective, dwelling in a morbid manner on their symptoms, and much inclined to take a despondent view of their condition. Very little progress can be made unless the physician gains

their confidence from the outset. Their fears and whims should not be made too light of or ridiculed. Systematic exercise, carefully regulated, particularly when, as at watering places, it is combined with a restricted diet, is of special service. Change of air and occupation, a prolonged sea voyage, or a summer in the mountains will sometimes cure the most obstinate dyspepsia.

(*b*) *Medicinal.*—The special therapeutic measures may be divided into those which attempt to replace in the digestive juices important elements which are lacking and those which stimulate the weakened action of the organ. In the first group come the hydrochloric acid and ferments, which are so freely employed in dyspepsia. The former is the most important. It is the ingredient in the gastric juice most commonly deficient. It is not only necessary for its own important actions, but its presence is intimately associated with that of the pepsin, as it is only in the presence of a sufficient quantity that the pepsinogen is converted into the active digestive ferment. It is best given as the dilute acid taken in somewhat larger quantities than are usually advised. Ewald recommends large doses—of from 90 to 100 drops—at intervals of fifteen minutes after the meals. Leube and Riegel advise smaller doses. Probably from 15 to 20 drops is sufficient. The prolonged use of it does not appear to be in any way hurtful. The use, however, should be restricted to cases of neurosis and atrophy of the mucous membrane. In actual gastritis its value is doubtful.

The digestive ferments: These are extensively employed to strengthen the weakened gastric and intestinal secretions. The use of pepsin, according to Ewald, may be limited to the cases of advanced mucous catarrh and the instances of atrophy of the stomach, in which it should be given, in doses of from 10 to 15 grains, with dilute hydrochloric acid a quarter of an hour after meals. It may be used in various different forms, either as a powder or in solution or given with the acid. The powder is much more certain. Pepsin wine is generally inert, as there is little of the ferment taken up by alcohol. It is important to use a reliable article. Much that is in the market is valueless.

Pancreatin is of equal or even greater value than the pepsin. Pains should be taken to use a good article, such as that prepared by Merck. It should be given in doses of from 15 to 20 grains, in combination with bicarbonate of soda. It is conveniently administered in tablets, each of which contains 5 grains of the pancreatin and the soda, and of these two or three may be taken fifteen or twenty minutes after each meal. Ptyalin and diastase are particularly indicated when the acid is excessive. The action of the former continues in the stomach during normal digestion. The malt diastase is often very serviceable given with alkalies.

Of measures which stimulate the glandular activity in chronic dyspepsia lavage is by far the most important, particularly in the forms characterized by the secretion of a large quantity of mucus. Luke-warm

water should be used, or, if there is much mucus, a one per cent salt solution, or a three to five per cent solution of bicarbonate of soda. If there is much fermentation the three per cent solution of boric acid may be used, or a dilute solution of carbolic acid. It is best employed in the morning on an empty stomach, or in the evening some hours after the last meal. It is perhaps preferable in the morning, except in those cases in which there is much nocturnal distress and flatulency. Once a day is, as a rule, sufficient, or, in the case of delicate persons, every second day. The irrigation may be continued until the water which comes away is quite clear. It is not necessary to remove all the fluid after the irrigation.

While perhaps in some hands this measure has been carried to extremes, it is one of such extraordinary value in certain cases that it should be more widely employed by practitioners. When there is an insuperable objection to lavage a substitute may be used in the form of warm alkaline drinks, taken slowly in the early morning or the last thing at night.

Of medicines which stimulate the gastric secretion the most important are the bitter tonics, such as quassia, gentian, columbo, cundurango, ipecacuanha, strychnia, and cardamoms. These are probably of more value in chronic gastritis than the hydrochloric acid. Of these strychnia is the most powerful, though none of them have probably any very great stimulating action on the secretion, and influence rather the appetite than the digestion. Of stomachics which are believed to favorably influence digestion the most important are alcohol and common salt. The former would appear to act in moderate quantities by increasing the acid in the gastric juice, and with it probably the pepsin formation. Others hold that it is not so much the secretory as the motor function of the stomach which the alcohol stimulates. In moderate quantities it has certainly no directly injurious influence on the digestive processes. Special care should be taken, however, in ordering alcohol to dyspeptics. If a patient has been in the habit of taking beer or light wines or stimulants with his meals, the practice may be continued if moderate quantities are taken. Beer, as a rule, is not well borne. A dry sherry or a glass of claret is preferable. In the case of women with any form of dyspepsia stimulants should be employed with the greatest caution, and the practitioner should know his patient well before ordering alcohol.

The importance of salt in gastric digestion rests upon the fact that its presence is essential in the formation of the hydrochloric acid. An increase in its use may be advised in all cases of chronic dyspepsia in which the acid is defective.

Treatment of Special Conditions.—Fermentation and flatulency. When the digestion is slow or imperfect, fermentation goes on in the contents, with the formation of gas and the production of lactic, butyric, and acetic acids. For the treatment of this condition careful dieting may suffice, particularly forbidding such articles as tea, pastry, and the coarser vegetables. It is usually combined with pyrosis, in which the

acid fluids are brought into the mouth. Bismuth and carbonate of soda sometimes suffice to relieve the condition. Thymol, creosote, and carbolic acid may be employed. For acid dyspepsia Sir William Roberts recommends the bismuth lozenge of the British Pharmacopœia, the antacid properties of which depend on chalk and bicarbonate of soda. It should be taken an hour or two after meals, and only when the pain and uneasiness are present. Glycerine in from twenty to sixty minim doses, the essential oils, animal charcoal alone or in combination with compound cinnamon powder, may be tried. If there is much pain, chloroform in twenty-minim doses or a teaspoonful of Hoffman's anodyne may be used. If obstinate, lavage is indicated and is sometimes striking in its effects. Alkaline solutions may be used.

Vomiting is not a feature which often calls for treatment in chronic dyspepsia; sometimes in children it is a persistent symptom. Creosote and carbolic acid in drop doses, a few drops of chloroform or of dilute hydrocyanic acid, cocaine, bismuth, and oxalate of cerium may be used. If obstinate, the stomach should be washed out daily.

Constipation is a frequent and troublesome feature of most forms of indigestion. Occasionally small doses of mercury, podophyllin, the laxative mineral waters, sulphur, and cascara may be employed. Glycerine suppositories or the injection of from half a teaspoonful to a teaspoonful of glycerine is very efficacious.

Many cases of chronic dyspepsia are greatly benefited by the use of mineral waters, particularly a residence at the springs with a careful supervision of the diet and systematic exercise. The strict *régime* of certain German Spas is particularly advantageous in the cases in which the chronic dyspepsia has resulted from excess in eating and in drinking. Kissingen, Carlsbad, Ems, and Wiesbaden are to be specially recommended.

IV. NEUROSES OF THE STOMACH.

(1) **Gastralgia; Gastrodynia.**—Severe pains in the epigastrium, paroxysmal in character, occur (*a*) as a manifestation of a functional neurosis, independent of organic disease, and usually associated with other nervous symptoms (it is this form which will here be described); (*b*) in chronic disease of the nervous system, forming the so-called gastric crises; and (*c*) in organic disease of the stomach, such as ulcer or cancer.

The functional neurosis occurs chiefly in women, very commonly in connection with disturbed menstrual function or with pronounced hysterical symptoms. The affection may set in as early as puberty, but it is more common at the menopause. Anæmic, constipated women who have worries and anxieties at home are most prone to the affection. It is more frequent in brunettes than in blondes. Attacks of it sometimes occur in robust, healthy men. More often it is only one feature in a condition of

general neurasthenia or a manifestation of that form of nervous dyspepsia in which the gastric juice or hydrochloric acid is secreted in excess. I am very skeptical as to the existence of a gastralgia of purely malarial origin.

The symptoms are very characteristic; the patient is suddenly seized with agonizing pains in the epigastrium, which pass toward the back and around the lower ribs. The attack is usually independent of the taking of food, and may recur at definite intervals, a periodicity which has given rise to the supposition in some cases that the affection is due to malaria. The most marked periodicity, however, may be in the gastralgic attacks of ulcer. They frequently come on at night. Vomiting is rare; more commonly the taking of food relieves the pain. To this, however, there are striking exceptions. Pressure upon the epigastrium commonly gives relief, but deep pressure may be painful. It seems scarcely necessary to separate the forms, as some have done, into irritative and depressive, as the cases insensibly merge into each other. Stress has been laid upon the occurrence of painful points, but they are so common in neurasthenia that very little importance can be attributed to them.

The *diagnosis* offers many difficulties. Organic disease either of the stomach or of the nervous system must be excluded. In the case of ulcer or cancer this is not always easy. I well remember the case of a poor fellow who was discharged from the Montreal General Hospital as a malingerer. He had been a soldier, was well nourished, had no vomiting, but had severe attacks of abdominal pain. The examination was negative, and it was thought to be a case of simulation. A week subsequent to his discharge he was readmitted with peritonitis from perforation. The fact that the pain is most marked when the stomach is empty and is relieved by the taking of food is sometimes regarded as pathognomonic of simple gastralgia, but to this there are many exceptions, and in cancer the pains may be relieved on eating. The prolonged intervals between the attacks and their independence of diet are important features in simple gastralgia; but in many instances it is less the local than the general symptoms of the case which enable us to make the diagnosis.

(2) **Nervous Dyspepsia.**—According to Leube, who first separated it from the ordinary gastric catarrh, nervous dyspepsia is characterized by sensations of distress and uneasiness during digestion, and yet the act is accomplished within the physiological time limit. The studies of Ewald, Oser, Rosenbach, and others have greatly extended our knowledge of the condition. The cases are met with most frequently in those who have either inherited a neurotic constitution or have gradually, through indiscretions, brought about a condition of nervous prostration. All grades occur, from the emaciated, skeleton-like subject of anorexia nervosa to the well-nourished, healthy-looking, fresh-complexioned patient whose constant complaint is distress and uneasiness after eating. If in a case of dyspepsia the stomach is found empty seven hours after the test dinner, the supposition is that the trouble is nervous (Leube). The separation of

the different forms can only be made accurately by the chemical examination of the juices.

Clinical Forms.—Leube recognizes three chief types. (*a*) Nervous dyspepsia with normal secretion. There is no dilatation of the stomach, no pain on pressure, and no change in the condition of the acid. The test meal is digested within the normal time. Yet, despite the fact that the motor and chemical functions of the organ are perfectly performed, there are distress and uneasiness during the act of digestion. The patient complains of pressure and distention of the stomach; eructations occur.

(*b*) The condition of subacidity or inacidity. Lack of the normal amount of acid is found in chronic catarrh, and particularly in cancer. According to Leube, reduction in the normal amount of acid may exist with the most pronounced symptoms of nervous dyspepsia, and yet the stomach will be free from food within the regular time. A condition in which the gastric juice is entirely without acid may occur in cancer, in extreme sclerosis of the mucous membrane, and as a nervous manifestation of hysteria, and occasionally of tabes. The most aggravated cases are those associated with hysteria and neurasthenia. In addition to the general symptoms, there are loss of appetite, sleeplessness, and gastric distress, and when the stomach is empty there are uneasy local sensations and general feelings of malaise, headache, and dizziness.

(*c*) Nervous dyspepsia with hyperacidity of the gastric juices. This is a form of dyspepsia which has long been recognized, but of late has been specially studied by Reichman and others. The percentage of acid may be doubled. This increase in the acid may be an intermittent condition or continuous. The periodic form is really a neurosis of secretion—*gastroxynsis* of Rosenbach—which may be quite independent of the time of digestion. Such cases are rare and are associated either with profound neurasthenia or with locomotor ataxia. The attack may last for several days. It usually sets in with a gnawing, unpleasant sensation of the stomach, severe headache, and shortly after the patient vomits a clear, watery secretion of such acidity that the throat is irritated and made raw and sore. As mentioned, the attacks may be quite independent of food. The chronic condition of hyperacidity is more common. Digestion is usually retarded, particularly for the starches, and there are eructations of acid fluid and gastric distress. There are instances also in which when the stomach contains no food there is a secretion of a highly acid juice. In these cases burning acid eructations, or even vomiting, occurring during the night or early in the morning, are quite characteristic.

The relation of hyperacidity to gastric ulcer will be considered later.

(3) **Nervous Vomiting; Peristaltic Unrest; Rumination.**—(*a*) *Nervous Vomiting*—a condition which is not associated with anatomical changes in the stomach or with any state of the contents, but is due to nervous influences acting either directly or indirectly upon the centres presiding over the act of vomiting. The patients are, as a rule, women—

usually brunettes—and the subject of more or less marked hysterical manifestations. A special feature of this form is the absence of the preliminary nausea and of the straining efforts of the ordinary act of vomiting. It is rather a regurgitation, and without visible effort and without gagging the mouth is filled with the contents of the stomach, which are then spat out. It comes on, as a rule, after eating, but may occur at irregular intervals. In some cases the nutrition is not impaired, a feature which may give a clew to the true nature of the disease, as there may be no other hysterical manifestation present. As noted by Tuckwell, it may occur in children. Nervous vomiting is rarely serious. Death may, however, follow, as in the case reported by Garland,* in which a young woman, aged twenty, had had from the age of two attacks of vomiting which lasted for twenty-four hours, and which were very apt to occur when the child was extra well and vivacious. She had St. Vitus's dance at eleven. At about the age of twenty, she had excessive muscular twitchings, clonic in character and uncontrollable, and amounting to violent motion of the muscles When twenty-two she had severe headache, gradually lost flesh, and became low-spirited. In January, 1884, she had headache, twitchings, and constant vomiting, and died on the 13th. There was slight atrophy of the mucous membrane of the stomach and slight increase in the firmness of the kidneys.

A type of vomiting is that associated with certain diseases of the nervous system—particularly locomotor ataxia—forming part of the gastric crises. Leyden has reported cases of primary periodic vomiting, which he regards as a neurosis.

(*b*) *Peristaltic Unrest.*—This condition, as described by Kussmaul, is an extremely common and distressing symptom in neurasthenia. Shortly after eating the peristaltic movements of the stomach are increased, and borborygmi and gurgling may be heard, even at a distance. The subjective sensations are most annoying, and it would appear as if in the hyperæsthetic condition of the nervous system the patient felt normal peristalsis, just as in these states the usual beating of the heart may be perceptible to him. A further analogy is afforded by the fact that emotion increases this peristalsis. It may extend to the intestines, particularly to the duodenum, and on palpation over this region the gurgling is most marked. The movement may be anti-peristalsis, in which the wave passes from left to right, a condition which may also extend to the intestines. There are cases on record in which colored enemata or even scybala have been discharged from the mouth.

(*c*) *Rumination; Merycismus.*—In this remarkable and rare condition the patients regurgitate and chew the cud like ruminants. It occurs in neurasthenic or hysterical persons, epileptics, and idiots. In some instances it is hereditary. There is an instance in which a governess taught

* Transactions of the Association of American Physicians, vol. iv.

Pica (translation of Kissa, the jay). The word applied by Greek physicians to the morbid appetite, supposed to indicate worm-infection, which was also called

it to two children. The habit may persist for years, and does not necessarily impair the health.

Treatment of Neuroses of the Stomach.—The gastralgia, if very severe, requires morphia, which is best administered subcutaneously in combination with atropia. In the milder attacks the combination of morphia (gr. $\frac{1}{8}$) with cocaine and belladonna is recommended by Ewald. The greatest caution should, however, be exercised in these cases in the use of the hypodermic syringe. It is preferable, if opium is necessary, to give it by the mouth, and not to let the patient know the character of the drug. Chloroform, in from ten to twenty drop doses, or Hoffman's anodyne will sometimes allay the severe pains. The general condition should receive careful attention, and in many cases the attacks recur until the health is restored by change of air with the prolonged use of arsenic. If there is anæmia iron may be given freely. Nitrate of silver in doses of gr. $\frac{1}{4}$ to $\frac{1}{2}$ in a large claret-glass of water taken on an empty stomach is useful in some cases.

Many cases of nervous dyspepsia with marked neurasthenic or hysterical symptoms do well on the Weir-Mitchell treatment, and in obstinate forms it should be given a thorough trial. The most striking results are perhaps seen in the cases of anorexia nervosa, which will be referred to subsequently. It is also of value in the nervous vomiting. In the distressing cases of hyperacidity, in addition to the treatment of the general neurotic condition, alkalies must be employed, either in the form of magnesia or bicarbonate of soda. The burning acid eructations are usually relieved in this way.

Limiting the patient to a strictly meat diet is a valuable procedure in many cases of dyspepsia associated with hyperacidity. The meat should be taken either raw or, if an insuperable objection exists to this, very slightly cooked. It is best given finely minced or grated on stale bread. An ample dietary is $3\frac{1}{4}$ ounces (100 grammes) of meat, two medium slices of stale bread, and an ounce (30 grammes) of butter. This may be taken three times a day with a glass of Apollinaris water, soda water, or, what is just as satisfactory, spring water. The fluid should not be taken too cold. Special care should be had in the examination of the meat to guard against tape-worm infection, but suitable instructions on this point can be given. This is sufficient for an adult man, and many obstinate cases yield satisfactorily to a month or six weeks of this treatment, after which time the less readily digested articles of food may be gradually added to the dietary. In other instances the use of the stomach-tube is most effectual.

There are forms of nervous dyspepsia occurring in women who are often well nourished and with a good color, yet who suffer—particularly at night—with flatulency and abdominal distress. The sleep may be quiet and undisturbed for two or three hours, when they are aroused with painful sensations in the abdomen and eructations. The appetite and diges-

tion may appear to be normal. Constipation is, however, usually present. In many of these patients the condition seems rather intestinal dyspepsia, and the distress is due to the accumulation of gases, the result of excessive putrefaction. The fats, starches, and sugars should be restricted. A diastase ferment is sometimes useful. The flatulency may be treated by the methods above mentioned. Naphthalin, salicylate of bismuth, and salol have been recommended. Some of these cases obtain relief from thorough irrigation of the colon at bedtime.

V. DILATATION OF THE STOMACH (*Gastrectasis*).

Etiology.—This may occur either as an acute or a chronic condition.

Acute dilatation is rarely seen, though it occurs whenever enormous quantities of food and drink are quickly ingested. Occasionally this leads to extreme paralytic dilatation, and Fagge has described two cases which came on in this way, one of which proved fatal.

Chronic dilatation results from: (*a*) Narrowing of the pylorus or of the duodenum by the cicatrization of an ulcer, hypertrophic stenosis of the pylorus (whether cancerous or simple), congenital stricture, or occasionally by pressure from without of a tumor or of a floating kidney. (*b*) Relative or absolute insufficiency of the muscular power of the stomach, due, on the one hand, to repeated overfilling of the organ with food and drink (*Ueberanstrengung des Magens*, Strümpell), and, on the other, to atony of the coats induced by chronic inflammation or degeneration or impaired nutrition, the result of constitutional affections, as cancer, tuberculosis, anæmia, etc.

The most extreme forms are met with in the first group, and most commonly as a sequence of the cicatricial contraction of an ulcer. There may be considerable stenosis without much dilatation, the obstruction being compensated by hypertrophy of the muscular coats. Considerable attention has been directed in Germany by Litten, Ewald, and others to the association of dilatation with dislocation of the right kidney. Two well-marked instances have come under my observation among a very large number of cases of movable kidney, but in neither was the dilatation extreme.

In the second group, due to atony of the muscular coats, we must distinguish between instances in which the stomach is simply enlarged and those with actual dilatation, the conditions which Ewald characterized as *megastrie* and *gastrectasis* respectively. The size of the stomach varies greatly in different individuals, and the maximum capacity of a normal organ Ewald places at about 1,600 c. c. Measurements above this point indicate absolute dilatation.

Atonic dilatation of the stomach may result from weakness of the

coats, due to repeated overdistention or to chronic catarrh of the mucous membrane, or to the general muscular debility which is associated with chronic wasting disorders of all sorts. The combination of chronic gastric catarrh with overfeeding and excessive drinking is one of the most fruitful sources of atonic dilatation, as pointed out by Naunyn. The condition is frequently seen in diabetics, in the insane, and in beer-drinkers. In Germany this form is very common in men employed in the breweries, who sometimes drink from twenty to thirty litres of beer in the day. The extraordinary size to which the organ attains in some of these cases is well shown by the *papier-maché* models which have been prepared under von Ziemssen's directions. Possibly muscular weakness of the coats may result in some cases from disturbed innervation. Dilatation of the stomach is most frequent in middle-aged or elderly persons, but the condition is not uncommon in children, especially in association with rickets.

Symptoms.—These are very variable and depend upon the cause and the degree of dilatation. Naturally the features in cancer of the pylorus would be very different from those met with in an excessive drinker. Dyspepsia is present in nearly all cases, and there are feelings of distress and uneasiness in the region of the stomach. The patient may complain much of hunger and thirst and eat and drink freely. The most characteristic symptom is the vomiting at intervals of enormous quantities of liquid and of food, amounting sometimes to four or more litres. The material is often of a dark-grayish color, with a characteristic sour odor due to the organic acids present, and contains mucus and remnants of food. On standing it separates into three layers, the lowest consisting of food, the middle of a turbid, dark-gray fluid, and the uppermost of a brownish froth. The microscopical examination shows a large variety of bacteria, yeast fungi, and the sarcina ventriculi. There may also be cherry stones, plum stones, and grape seeds.

Chemically the hydrochloric acid may be absent, diminished, normal, or in excess, depending upon the cause of the dilatation. The fermentation produces lactic, butyric, and, possibly, acetic acids and various gases.

In consequence of the small amount of fluid which passes from the stomach or is absorbed there are constipation, scanty urine, and extreme dryness of the skin. The general nutrition of the patient suffers greatly; there is loss of flesh and strength, and in some cases the most extreme emaciation. A very remarkable symptom which occurs occasionally is tetany, first described by Küssmaul. The spasm affects chiefly the muscles of the hands, arms, and legs. Loss of consciousness may occur. The spasms last for a short time only. Müller has collected eight cases of the kind, two of which occurred in simple dilatation of the stomach.

Physical Signs.—*Inspection.*—The abdomen may be large and prominent, the greatest projection occurring below the navel in the standing posture. In some instances the outline of the distended stomach can be

plainly seen, the small curvature a couple of inches below the ensiform cartilage, and the greater curvature passing obliquely from the tip of the tenth rib on the left side, toward the pubes, and then curving upward to the right costal margin. There are instances in which inspection alone reveals, at a glance, the nature of the case. Active peristalsis may be seen in the dilated organ, the waves passing from left to right. Occasionally anti-peristalsis may be seen. In cases of stricture, particularly of hypertrophic stenosis, as the peristaltic wave reaches the pylorus, the tumor-like thickening can sometimes be distinctly seen through the thin abdominal wall. To stimulate the peristalsis the abdomen may be flipped with a wet towel.

Palpation.—The peristalsis may be felt, and usually in stenosis the tumor is evident at the pylorus. The resistance of a dilated stomach is peculiar, and has been aptly compared to that of an air cushion. Bimanual palpation elicits a splashing sound, which is, of course, not distinctive, as it can be obtained whenever there is much liquid and air in the organ, but it cannot be obtained in a healthy person two or three hours after eating. The splashing may be very loud, and the patient may produce it himself by suddenly depressing the diaphragm, or it may be readily obtained by shaking him. A tube passed into the stomach may be felt externally through the skin, a procedure no longer recommended by Leube, who suggested it.

Percussion.—The note is tympanitic over the greater portion of a dilated stomach; in the dependent part the note is dull. In the upright position the percussion should be made from above downward, in the left parasternal line, until a change in resonance is reached. The line of this should be marked, and the patient examined in the recumbent position, when it will be found to have altered its level. When this is on a line with the navel or below it, dilatation of the stomach may generally be assumed to exist. This sign may be deceptive in women with lax abdomen, as the whole organ may be depressed, the lesser curvature coming, perhaps, as low as the navel. The fluid may be withdrawn from the stomach with a tube, and the dulness so made to disappear, or it may be increased by pouring in more fluid. In cases of doubt the organ may be artificially distended with carbonic-acid gas. A teaspoonful of bicarbonate of soda is first given in a little water, and then the same quantity of tartaric acid. The most accurate method of determining the size of the stomach is by inflation through a stomach-tube with a Davidson's syringe. Pacanowski has shown that the greatest vertical diameter of gastric resonance in the normal stomach varies from 10 to 14 cm. in the male and is about 10 cm. in the female.

Auscultation.—The *clapotement* or succussion can be obtained readily. Frequently a curious sizzling sound is present, not unlike that heard when the ear is placed over a soda-water bottle when first opened. It can be heard naturally, and is usually evident when the artificial gas is being

generated. The heart sounds may sometimes be transmitted with great clearness and with a metallic quality.

Mensuration may be used by passing a hard sound into the stomach until the greater curvature is reached. Normally it rarely passes more than 60 cm., measured from the teeth, but in cases of dilatation it may pass as much as 70 cm.

Diagnosis.—The diagnosis can usually be made without much difficulty by attention to these methods of examination. Curious errors, however, are on record, one of the most remarkable of which was the confounding of dilated stomach with an ovarian cyst; even after tapping and the removal of portions of food and fruit seeds, abdominal section was performed and the dilated stomach opened. The *prognosis* is bad in cases in which there is stenosis of the pylorus, either simple or cancerous.

Treatment.—With care, the dilatation consequent upon simple stenosis is not incompatible with many years of life. In the cases due to atony careful regulation of the diet and proper treatment of the associated catarrh will suffice to effect a cure. Strychnine, ergot, and iron are recommended. Washing out the stomach is of great service, though we do not see such striking and immediate results in this form. In cases of mechanical obstruction the stomach should be emptied and thoroughly washed, either with warm water or with an antiseptic solution. As Welch states, in his exhaustive article on this subject, we accomplish in this way three important things: We remove the weight, which helps to distend the organ; we remove the mucus and the stagnating and fermenting material which irritates and inflames the stomach and impedes digestion; and we cleanse the inner surface of the organ by the application of water and medicinal substances. The introduction of this method by Kussmaul, in 1867, has practically revolutionized the treatment in diseases of the stomach. The method of application has already been referred to. The patient can usually be taught to wash out his own stomach, and in a case of dilatation from simple stricture I have known the practice to be followed daily for three years with great benefit. The rapid reduction in the size of the stomach is often remarkable, the vomiting ceases, the food is taken readily, and in many cases the general nutrition improves rapidly. As a rule, once a day is sufficient, and it may be practised either the first thing in the morning or before going to bed. So soon as the fermentative processes have been checked, lukewarm water alone should be used.

The food should be taken in small quantities at frequent intervals, and should consist of scraped beef, Leube's beef solution, and tender meats of all sorts. Fatty and starchy articles of diet are to be avoided. Liquids should be taken sparingly.

In cicatricial stenosis of the pylorus Loreta has practised dilatation with considerable success. The statistics of Barton show that of 25 published cases 15 recovered and 10 died.

VI. THE PEPTIC ULCER—GASTRIC AND DUODENAL.

The round, perforating or simple ulcer is usually single and occurs in the stomach and in the duodenum as far as the papilla biliaria. It probably follows nutritional disturbance in a limited region of the mucosa, which results in the gradual destruction of this area by the gastric juice. The condition is usually associated with hyperacidity.

Etiology.—Clinically the simple ulcer is not so frequent as the statistics of post-mortems would lead us to expect; thus in the extensive records collected by Welch ulcer, cicatrized or open, was present in about five per cent of persons dying from all causes. The scars are found more frequently than the open ulcer.

Females are more frequently affected than males. Of 1,699 cases collected from hospital statistics by Welch, and examined post mortem, 40 per cent were in males and 60 per cent were in females. He gives the age incidence in 607 cases, of which three fourths were distributed between the ages of twenty and sixty, with tolerable uniformity in the four decades. In females the largest number of cases occurs between twenty and thirty; in males, between thirty and forty. Ulcer occasionally occurs in children, and Goodhart has reported a case in an infant thirty hours old. Gastric ulcer is stated to be less common in this country than in Europe.

In women it is frequent among servant girls, and in men who follow such occupations as shoe-making, weaving, and tailoring, possibly connected, as Habershon suggested, with pressure on the stomach. This view has been developed by Rasmussen, who holds that pressure of the costal margin, from various causes, induces anæmia and atrophy of the mucous membrane, particularly in the region of the smaller curvature. Very rarely the disease originates from traumatism or the action of corrosive fluids. Gastric ulcer is associated in a special manner with certain diseases, in women with anæmia and chlorosis and with menstrual disorders. It is not infrequently met with in tuberculosis. Such cases are not, however, to be mistaken for the true tuberculous ulcer, which may be found in the stomach.

Many cases have occurred in connection with disease of the heart or of the blood-vessels, a relation of special interest in connection with the embolic theory of its production.

The duodenal ulcer is less common than the gastric ulcer, and occurs most frequently in males. The combined statistics of Krauss, Chvostek, Lebert, and Trier give 171 cases in males and 39 in females. In 9 cases which have come under my observation 7 were in males and 2 in females; one of these was in a lad of twelve. It has been found in association with tuberculosis, and may follow large superficial burns.

Morbid Anatomy.—Though usually single, the ulcers may be multiple. In none of my cases were there more than five, but there is an instance

on record of thirty-four. The ulcer is situated most commonly on the posterior wall of the pyloric portion at or near the lesser curvature. It is not nearly so frequent on the anterior wall. Of 793 cases collected by Welch from hospital statistics, 288 were on the lesser curvature, 235 on the posterior wall, 95 at the pylorus, 69 on the anterior wall, 50 at the cardia, 29 at the fundus, 27 on the greater curvature. The duodenal ulcer is usually situated just outside the ring in the first portion of the gut.

The ulcer varies from 1 to 10 cm. in diameter. It may be small and punched out, or it may reach an enormous size. The largest of which I have any knowledge is one reported by Peabody, which measured 19 by 10 cm. and involved all of the lesser curvature and spread over a large part of the anterior and posterior walls. The ulcer is usually round or oval in shape, but may be irregular with sinuous borders. It is often distinctly terraced. In acute cases the mucous membrane is sharply cut, as if punched out by an instrument. In old cases the edge is indurated and loses the sharp margin. The floor is formed either by the submucosa, by the muscular layers, or, not infrequently, by the neighboring organs, to which the stomach has become attached. In the healing of the ulcer, if the mucosa is alone involved, the granulation tissue develops from the edges and the floor and the newly formed tissue gradually contracts and unites the margins, leaving a smooth scar. In larger ulcers which have become deep and involved the muscular coat the cicatricial contraction may cause serious changes, the most important of which is narrowing of the pyloric orifice and consequent dilatation of the stomach. In the case of a girdle ulcer, hour-glass contraction of the stomach may be produced. It is probable that large ulcers persist for years without any attempt at healing.

The ulcer may deepen and penetrate the coats. Fortunately, in a majority of the cases, adhesions form between the stomach and adjacent organs, particularly with the pancreas, the left lobe of the liver, and the omental tissues On the anterior surface of the stomach adhesions do not so readily form, hence the great danger of the ulcer in this situation, which more readily perforates and excites a diffuse and fatal peritonitis. On the posterior wall the ulcer penetrates directly into the lesser peritoneal cavity, in which case it may produce an air-containing abscess with the symptoms of the condition known as subphrenic pyo-pneumothorax. In rare instances adhesions and a gastro-cutaneous fistula form, usually in the umbilical region. Fistulous communication with the colon may also occur, or a gastro-duodenal fistula. There are several instances on record of perforation into the pericardium, and at least two of rupture into the left ventricle. Perforation into the pleura may also occur. It is to be noted that general emphysema of the subcutaneous tissues occasionally follows perforation of a gastric ulcer.

One of the most serious effects of gastric ulcer is erosion of blood-vessels. The hæmorrhage may occur in the acutely formed ulcer or in the

ulceration which takes place at the base of the chronic form; it is in the latter condition that the bleeding is most common. Ulcers on the posterior wall may erode the splenic artery, but perhaps more frequently the bleeding proceeds from the artery of the lesser curve. In the case of duodenal ulcer the pancreatico-duodenal artery may be eroded or (as in one of my cases) fatal hæmorrhage may result from the opening of the hepatic artery, or more rarely the portal vein. Interesting changes occur in the vessels. Embolism of the artery supplying the ulcerated region has been met with in several cases; in others diffuse endarteritis. Small aneurisms have been found in the floor of the ulcers by Douglas Powell, Welch, and others.

The mode of the origin of the peptic ulcer has been much discussed. Ulcers have been produced in animals in many ways, both by artificial emboli and by direct chemical and mechanical irritants applied to the mucosa. The ulcers thus produced heal with great rapidity unless the animals have been rendered anæmic by repeated abstraction of blood. Virchow's view that the process may result from plugging the nutrient artery of the part, either by an embolus or by a thrombus, and the infarct so produced is destroyed by the gastric juice, has gained general acceptance. It is in conformity with Pavy's well-known experiments and with the anatomical facts already mentioned, particularly with the funnel-like shape of the ulcer, and the actual demonstration, in some cases, of the plugged vessels; but this view scarcely meets all the cases, in many of which the etiology is still obscure. Mere mechanical injury to the mucous membrane is, however, in most cases, insufficient cause for an ulcer, for normally the stomach is perfectly able to withstand such insults. Ewald concludes that certain predisposing causes play an important *rôle* in its development. He points to its frequency in conditions of amenorrhœa, chlorosis, anæmia after confinements, etc., where one may assume that the condition of the blood is not wholly normal, and also to the fact that in the majority of cases of this affection there is a hyperacidity of the gastric juice. One or both of these predisposing factors seem to be present in most cases, and it has been recently shown that in the various anæmiæ there is an appreciable diminution in the normal alkalinity of the blood, a fact which tends to explain one of the predisposing causes in these affections, and which is in accord with the "alkalescence theory" of Cohnheim *et al.* The duodenal ulcer has an identical origin, but a few cases of acute ulcer, as already mentioned, have a curious relation with superficial burns. In one of my cases there was an ulcer in the posterior wall of the duodenum, 1·5 cm. in diameter, with overlapping edges, and not far from it was a cyst-like cavity in the submucosa associated with Brunner's glands, and it is possible that the open ulcer, with undermined edges, resulted from the rupture of one of these cysts.

Symptoms.—The condition may be met with accidentally, post mortem, in cases which have presented no indication of gastric disturbance.

In other instances the first symptoms may be due to perforation. In others again the symptoms, for months and years, may be those of ordinary dyspepsia, and the ulcer may not have been suspected until the occurrence perhaps of a sudden hæmorrhage.

The symptoms suggestive of peptic ulcer are: (*a*) Dyspepsia, which may be slight and trifling or of a most aggravated character. In a considerable proportion of all cases nausea and vomiting occur, the latter not for two or more hours after eating. The vomitus usually contains a large amount of HCl.

(*b*) Hæmorrhage is present in at least one half of all cases. It may be slight, but more commonly is profuse, and may be in such quantities and brought up so quickly that it is fluid, bright red in color, and quite unaltered. When the blood remains for some time in the stomach and is mixed with food it may be greatly changed, but the vomiting of a large quantity of unaltered blood is very characteristic of ulcer. Syncope may follow or death may directly result from the hæmorrhage. A most extreme grade of anæmia may be produced. In either the gastric or duodenal ulcer, more commonly in the latter, the blood may be passed in the stools and not be vomited. This may occur when the hæmorrhage is slight, but also when it is profuse enough to produce collapse and extreme anæmia.

(*c*) Pain is perhaps the most constant and distinctive feature of ulcer. It varies greatly in character; it may be only a gnawing or burning sensation, which is particularly felt when the stomach is empty, and is relieved by taking food, but the more characteristic form comes on in paroxysms of the most intense gastralgia, in which the pain is not only felt in the epigastrium, but radiates to the back and to the sides. These attacks are most frequently induced by taking food, and they may recur at a variable period after eating, sometimes within fifteen or twenty minutes, at others as late as two or three hours. It is usually stated that when the ulcer is near the cardia the pain is apt to set in earlier, but there is no certainty on this point. The attacks may occur at intervals with great intensity for weeks or months at a time, so that the patient constantly requires morphia, then again they may disappear entirely for a prolonged period. In the attack the patient is usually bent forward, and finds relief from pressure in the epigastric region; one patient during the attack would lean over the back of a chair; another would lie flat on the floor, with a hard pillow under the abdomen. Pressure is, as a rule, grateful. It has been thought that the posture assumed during the attack would indicate the site of the ulcer, but this is very doubtful.

(*d*) Tenderness on pressure is a common symptom in ulcer, and patients wear the waist-band very low. There may be a painful point of very limited extent, most frequently an inch or two below the ensiform cartilage. In old ulcers with thickened bases an indurated mass can usually be felt in the neighborhood of the pylorus. Pressure should be made

with great care, as rupture of an ulcer has been induced by careless manipulation.

(*e*) Of general symptoms, loss of weight results from the prolonged dyspepsia, but it rarely, except in association with cicatricial stenosis of the pylorus, reaches the high grade met with in cancer. The anæmia may be extreme, and in one case of duodenal ulcer which I examined the blood count was as low as 700,000 per c. mm. There are instances, such as the one reported by Pepper and Griffith, in which the extreme anæmia cannot be explained by the occurrence of hæmorrhage.

According to Welch, perforation occurs in about six and a half per cent of all cases. The acute, perforating form is much more common in women than in men. The symptoms are those of perforative peritonitis. In some instances the pain associated with perforation is not referred to the abdomen. In a case of H. C. Wood's the chief symptoms were pain in the left shoulder and excessive pain in the back on movement. Perforation is not necessarily fatal. Several cases of recovery have been reported.

The course of the disease is, in the majority of cases, chronic. Only a few instances run a very acute course. The following group of clinical forms, described by Welch, indicate the diversity of this affection:

"1. Latent ulcers, with entire absence of symptoms, and revealed as open ulcers or as cicatrices at the autopsy.

"2. Acute perforating ulcers. With or without a period of brief gastric disturbance, perforation occurs and causes speedy death.

"3. Acute hæmorrhagic form of gastric ulcer. After a latent or a brief course of the ulcer, profuse gastrorrhagia occurs, which may terminate fatally or may be followed by the symptoms of chronic ulcer.

"4. Gastralgic-dyspeptic form. In this, which is the most common form of gastric ulcer, gastralgia, dyspepsia, and vomiting are the symptoms. Sometimes one of the symptoms predominates greatly over the others, so that Lebert distinguishes separately a gastralgic, a dyspeptic, and a vomitive variety. Gastralgia is the most frequent symptom.

"5. Chronic hæmorrhagic form. Gastrorrhagia is a marked symptom, and occurs usually in combination with the symptoms just mentioned.

"6. Cachectic form. This usually corresponds only to the final stage of one of the preceding forms, but the cachexia may develop so rapidly and become so marked that the course of the disease closely resembles that of gastric cancer.

"7. Recurrent form. In this the symptoms of gastric ulcer disappear, and then follow intervals, often of considerable duration, in which there is apparent cure, but the symptoms return, especially after some indiscretion in the mode of living. This intermittent course may continue for many years. In these cases it is probable either that fresh ulcers form or that the cicatrix of an old ulcer becomes ulcerated.

"8. Stenotic form. By the formation of cicatricial tissue in and

around the ulcer, the pyloric orifice becomes obstructed and the symptoms of dilatation of the stomach develop."

The course may be very protracted, and there are cases in which the disease has persisted for over twenty years. I have reported two instances of peptic ulcer, probably duodenal, in which well-marked symptoms were present, in one case for eighteen, and in the other for twelve years. Both were of the chronic hæmorrhagic form.

Diagnosis.—The recognition of gastric ulcer is in many cases easy, as the combination of dyspepsia, gastralgic attacks, and hæmatemesis is very characteristic. Of the symptoms, hæmorrhage with the gastralgic attack is the most characteristic. The distinctions between ulcer and cancer will be given. The greatest difficulty is offered by certain cases of gastralgia, which may resemble ulcer very closely, as, with the exception of the hæmorrhage, there is no single symptom which may not be present. Even with hæmorrhage the case may not be clear, and no less an authority than the late Austin Flint made a diagnosis of recurring gastralgia in a patient who had, on and off for nine years, violent pains with vomiting in association with ulcer. A difficulty also results from the fact that in many instances gastralgia is one of the symtoms of nervous dyspepsia, and may exist with marked emaciation.

The following points are of value in discriminating between these two conditions:

(*a*) In ulcer the pain is more definitely connected with taking food, though this is not always the case, as in the duodenal form the gastralgic attacks may occur at night when the stomach is empty. Relief of pain after eating is certainly less common in ulcer than in gastralgia, though it is a very uncertain feature, and in certain cases the pain in ulcer is *always* relieved by taking food.

(*b*) In ulcer dyspeptic symptoms are almost invariably present in the intervals between the attacks, and even when pain is absent there is slight distress.

(*c*) Local sensitiveness in a particular spot in the epigastrium is suggestive of ulcer. External pressure usually aggravates the pain in ulcer, and often relieves it in gastralgia. This is, however, a very uncertain feature, as patients writhing with the pains of ulcer may press the abdomen over the back of a chair or place a hard pillow under it.

(*d*) The general condition and history of the patient often give the most trustworthy information. The nutrition is impaired more frequently in ulcer than in gastralgia. In the former we find more commonly (in women) dysmenorrhœa and chlorosis, while in the latter there are associated nervous phenomena—hysterical manifestations or neuralgias in other regions.

(*e*) On examination of the abdomen, not only is pain on pressure much more common in ulcer, but there may also be thickening about the pylorus and, in many cases, signs of dilatation of the stomach.

(*f*) Hyperacidity of the gastric juice exists with ulcer.

The *gastric crises* which occur in affections of the spinal cord, particularly in locomotor ataxia, may simulate very closely the gastralgic attacks of ulcer, and as they so often exist in the preataxic stage their true nature may be overlooked; but the occurrence of lightning pains, the ocular symptoms, and the absence of the knee reflex are indications usually sufficient to render the diagnosis clear.

Can the gastric and duodenal ulcer be distinguished clinically? As already stated, they originate in the same way and present the same anatomical characters. In the great majority of cases they cannot be separated during life, as the symptoms produced are identical. Bucquoy has suggested that the duodenal ulcer can be distinguished by the following definite characters: (*a*) Sudden intestinal hæmorrhage in an apparently healthy person, which tends to recur and produce a profound anæmia. Hæmorrhage from the stomach may precede or accompany the melæna. (*b*) Pain in the right hypochondriac region, coming on two or three hours after eating. (*c*) Gastric crises of extreme violence, during which the hæmorrhage is more apt to occur. Certainly the occurrence of sudden intestinal hæmorrhage with gastralgic attacks is extremely suggestive of duodenal ulcer. W. W. Johnston has reported an instance in which he made the diagnosis on these symptoms, and in one of the Montreal cases Palmer Howard suggested correctly the presence of a duodenal ulcer on similar grounds. A patient under my care who had, during eighteen years, frequent attacks of hæmatemesis with gastralgia had melæna repeatedly without vomiting blood;* but as a rule in the attacks the blood was vomited first, and did not appear in the stools until later. Occasionally this symptom will be found an important aid in diagnosis. The situation of the pain is too uncertain a factor on which to lay much stress, and the character of the crises is usually identical.

Gall-stone colic may occasionally simulate the pains of gastric ulcer. The sudden onset and as sudden termination, the swelling and tenderness of the liver, the enlargement of the gall-bladder, if present, and the occurrence of jaundice are points which usually make the diagnosis clear.

Treatment.—Post-mortem observations show that a very large number of ulcers heal completely, but the process is slow and tedious, often requiring months, or, in severe cases, years. The following are the important points in treatment:

(*a*) Absolute rest in bed.

(*b*) A carefully and systematically regulated diet. While theoretically it is better to give the stomach complete rest by rectal feeding, yet in practice this strict limitation is not found satisfactory. The food should be bland, easily digested, and given at stated intervals. The following dietary will be found useful: At 8 A. M. give 200 c. c. of Leube's beef solu-

* On the Diagnosis of Duodenal Ulcer, Medical Record, November 24, 1888.

tion; at 12 M., 300 c. c. of milk gruel or peptonized milk. The gruel should be made with ordinary flour or arrowroot, and is mixed with an equal quantity of milk. If necessary it may be peptonized. Buttermilk is very well borne by these patients. At 4 P. M. the beef solution again, and at 8 P. M. the milk gruel or the buttermilk.

The stomach in some cases is so irritable that the smallest amount of food is not well borne. In such cases lavage may be practised, if necessary, every morning and evening, with mildly alkaline water, after which the beef solution is given and the feeding supplemented by the rectal injections. Ill effects rarely follow the careful use of the stomach tube in gastric ulcer. There are some cases which do well from the outset on a milk diet, given at regular intervals, three or four ounces every two hours. When milk is not well borne egg albumen may be substituted, or the whites of eight eggs may be alternated with Leube's beef solution. At the end of a month, if the condition has improved, the patient may be allowed scraped beef or young chicken, perfectly fresh sweet-bread, and farinaceous puddings made with milk and eggs. Local applications, such as warm fomentations, over the abdomen are very useful. The patient should be told that the treatment will take at least three months, and for the greater portion of the time he should be in bed.

(*c*) Medicinal measures are of very little value in gastric ulcer, and the remedies employed do not probably benefit the ulcer, but the gastric catarrh. The Carlsbad salts are warmly recommended by von Ziemssen. The artificial preparation (sulphate of sodium, 50; bicarbonate of sodium, 6; chloride of sodium, 3) may be substituted, of which a teaspoonful is taken every morning. Bismuth, in doses of thirty to sixty grains three times a day, and nitrate of silver may be given, but they influence the associated conditions rather than the ulcer.

The pain if severe requires opium. Unless the gastralgia is intense morphia should not be given hypodermically, as there is a very serious danger in these cases of establishing the morphia habit. Doses of an eighth of a grain, with the bicarbonate of soda and bismuth, will allay the mild attacks, but the very severe ones require the hypodermic injection of a quarter or often half a grain. Antipyrin and antifebrin may be tried, but, as a rule, are quite ineffectual. In the milder attacks Hoffman's anodyne, or twenty or thirty drops of chloroform, or the spirits of camphor will give relief. Counter-irritation over the stomach with mustard or cantharides is often useful.

For the vomiting there is no measure so successful as lavage. If intractable the patient must be fed per rectum. The patient will sometimes retain food which is passed into the stomach through the tube, and Leube's beef solution or milk may be given in this way. Cracked ice, chloroform, oxalate of cerium, bismuth, hydrocyanic acid, and ingluvin may be tried. When hæmorrhage occurs the patient should be put under the influence of opium as rapidly as possible. No attempt should be made

to check the hæmorrhage by administering medicines through the mouth; as the profuse bleeding is always from an eroded artery, frequently from one of considerable size, it is doubtful if acetate of lead, tannic and gallic acids, and the usual remedies have the slightest influence. The essential point is to give rest, which is best obtained by opium. Ergotin may be administered hypodermically in two-grain doses. Nothing should be given by the mouth except small quantities of ice. In profuse bleeding a ligature may be applied around a leg, or a leg and arm. Not infrequently the loss of blood is so great that the patient faints. A fatal result is not, however, very common from hæmorrhage. Transfusion may be necessary, or, still better, the subcutaneous infusion of saline solution.

The patients usually recover rapidly from the hæmorrhage and require iron in full doses, which may, if necessary, be given hypodermically.

VII. CANCER OF THE STOMACH.

Etiology.—The stomach comes next to the uterus as the most frequent seat of primary cancer, amounting, as shown by the statistics of Welch,* to 21·4 per cent in a total of over 30,000 cases. The ratio of males to females affected is about five to four. Age has an important bearing. Of 2,038 cases tabulated by this author three fourths occurred between the fortieth and the seventieth year, 24·5 per cent between the ages of forty and fifty, and 30·4 between the ages of fifty and sixty. In childhood it is extremely rare. Cancer of the stomach is a very common disease in this country, though statistics would indicate that it is rather less frequent than in Europe. With reference to heredity, Welch analyzed 1,744 cases and found that a family history was present in 243. Local conditions, such as chronic gastritis and traumatism, have been thought by some to be important factors. Cancer may develop in a simple ulcer of the stomach, but this sequence is extremely rare. It is not probable that depressing emotions, mode of life, or previous disease have any influence whatever in the causation of cancer.

Morbid Anatomy.—The most common varieties of gastric cancer are the cylindrical-celled epithelioma and the encephaloid; next in frequency is scirrhous, and then colloid cancer. With reference to the situation of the tumor, Welch analyzed 1,300 cases, in which the distribution was as follows: Pyloric region, 791; lesser curvature, 148; cardia, 104; posterior wall, 68; the whole or greater part of the stomach, 61; multiple tumors, 45; greater curvature, 34; anterior wall, 30; fundus, 19.

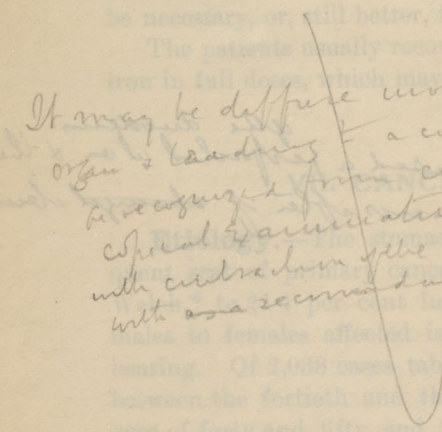
The medullary cancer occurs in soft masses, which involve all the coats of the stomach and usually ulcerate early. The tumor may form villous projections or cauliflower-like outgrowths. It is soft, grayish white in color,

* System of Medicine, vol. ii, Philadelphia, 1886.

The Surgical treatment of the peptic ulcer is
really quite

Dean (B. M. J. 5.12.94) Excised a perforated ulcer of the duodenum
with stomach recovered. Dying 2 mos after of stomach ulcer
shield.

Look up, particularly, sequence at long intervals.
see Mc Carthy's case Can. Practit. April 1894



It may be diffuse involving all parts of the organ + causing [illegible] a condition which cannot be recognized from cirrhosis except on microscopical examination. This diffuse scirrhus with contraction of the organ has also been met with as a recommending + cancer of the ovaries

and contains much blood. Microscopically it shows a scanty stroma, enclosing alveoli which contain irregular polyhedral and cylindrical cells. The cylindrical-celled epithelioma may also form large irregular masses, but the consistence is usually firmer, particularly at the edges of the cancerous ulcers. Microscopically the section shows elongated tubular spaces filled with columnar epithelium, and the intervening stroma is abundant. Cysts are not uncommon in this form. The scirrhous variety is characterized by great hardness, due to the abundance of the stroma and the limited amount of alveolar structures. It is seen most frequently at the pylorus, where it is a common cause of stenosis. It may be combined with the medullary form. The colloid cancer is peculiar in its wide-spread invasion of all the coats. It also spreads with greater frequency to the neighboring parts, and it occasionally causes extensive secondary growths of the same nature in other organs. The appearance on section is very distinctive, and even with the naked eye large alveoli can be seen filled with the translucent colloid material. The term alveolar cancer is often applied to this form. Ulceration is not constantly present, and there are instances in which, with most extensive disease, digestion has been very slightly disturbed. There is a specimen in the Warren Museum, at the Harvard Medical School, of the most wide-spread colloid cancer, in which the stomach contained after death large portions of undigested beef-steak.

Secondary cancer may also occur in the stomach. Welch has collected 37 cases, 17 of which were secondary to cancer of the breast. The cancer may produce important changes in the position and shape of the organ, particularly when the orifices are involved; thus, a cancer at the cardia may be associated with wasting of the organ and reduction in its size. The œsophagus above the obstruction may be greatly distended. On the other hand, annular cancer at the pylorus may cause stenosis and great dilatation of the organ; not necessarily, however, as there are instances on record in which the pylorus has been extremely narrowed without any increase in the size of the stomach. In scirrhous cancer the organ may be very greatly thickened and contracted. The stomach may be displaced or altered in shape by the weight of the tumor, particularly in cancer of the pylorus, which has been found in every region of the abdomen, and even in the true pelvis. The mobility of the tumors is at times extraordinary and very deceptive. There was in the Philadelphia Hospital an old man with a tumor at the pylorus the size of a cricket ball, which was usually in the epigastric region, but could be pushed into the right hypochondria or into the splenic region entirely beneath the ribs. Adhesions very frequently occur, particularly to the colon, the liver, and the anterior abdominal wall.

Secondary cancerous growths are very frequent, as shown by the following analysis by Welch of 1,574 cases: Metastasis occurred in the lymphatic glands in 551; in the liver in 475; in the peritonæum, omentum, and intestine in 357; in the pancreas in 122; in the pleura and lung in

98; in the spleen in 26; in the brain and meninges in 9; in other parts in 92. The lymph glands affected are usually those of the abdomen, but the cervical and inguinal glands are not infrequently attacked, and give an important clew in diagnosis. Occasionally, a secondary metastatic growth occurs subcutaneously, either at the navel or beneath the skin in the vicinity. In an instance recently under observation in a patient with jaundice, which developed somewhat suddenly and was believed to be catarrhal, there were no signs of enlargement of the liver or tumor of the stomach, but a nodular body developed at the navel, which on removal proved to be typical scirrhus. A second case in the ward at the same time, with an obscure doubtful tumor in the left hypochondria, developed a painful nodular subcutaneous growth midway between the navel and the left margin of the ribs.

In the extensive ulceration which occurs perforation of the stomach is not uncommon. It occurred into the peritonæum in 17 of the 507 cases of cancer of the stomach collected by Brinton. When adhesions form, the most extensive destruction of the walls may take place without perforation into the peritoneal cavity. In one instance which came under my observation a large portion of the left lobe of the liver lay within the stomach. Occasionally a gastro-cutaneous fistula is established. Perforation may occur into the colon, the small bowel, the pleura, the lung, or into the pericardium.

Symptoms.—Cancer of the stomach may not produce symptoms other than gradual failure of health, and death may take place from asthenia without any suspicion of the existence of malignant disease. These cases are not uncommon, particularly in elderly persons in institutions. In a great majority of all cases there are very definite symptoms, but the disease presents a very diverse clinical picture. Certain general features stand out with special prominence. The onset is insidious, sometimes with gastric disturbance, but more commonly with impairment of health and strength. A dyspepsia which may have been troublesome for years becomes aggravated. Ewald, however, states that dyspeptic symptoms are rare prior to the onset of gastric cancer. There are attacks of nausea and vomiting, and there is pain in the region of the stomach, which is aggravated by taking food. The patient emaciates, the anæmia becomes pronounced, and the prostration may be extreme. With slight intermissions the course is progressively downward, and from month to month the loss is striking. The face has a sallow cachectic appearance, the anæmia becomes more intense, and there may be œdema of the ankles. Blood may be present in the vomited matter. If with these general features a tumor can be felt in the region of the stomach the diagnosis is rendered certain. The course, in rapid cases, may be from three to six months, but as a rule the disease extends from eighteen months to two years.

Dyspepsia is common at the outset, but in so many cases the patients

acute cancer

have had indigestion for years that the trouble is supposed at first to be only an aggravation of the chronic complaint. Loss of the desire for food is a very frequent symptom. There are exceptional instances, however, in which the appetite is retained throughout, and the functions of the stomach very slightly disturbed. Nausea is a striking feature in many cases, and is much more common than in ulcer. There may even be a sudden repulsion at the sight of food.

Vomiting, which is one of the most constant symptoms of cancer of the stomach, may come on early, or only after the dyspepsia has persisted for some time. At first it is at long intervals, but subsequently it is more frequent, and may recur several times in the day. There are cases in which it comes on in paroxysms and then subsides; in other cases, it sets in early, persists with great violence, and may cause a fatal termination within a few weeks. Vomiting is more frequent when the cancer involves the orifices, particularly the pylorus, in which case it is usually delayed for an hour or more after taking the food. When the cardiac orifice is involved it may follow at a shorter interval. Extensive disease of the fundus or of the anterior or posterior wall may be present without the occurrence of vomiting. The vomited matters consist of food and mucus in a grayish or dark sour-smelling fluid. The food is sometimes very little changed, even after it has remained in the stomach for twenty-four hours.

Hæmorrhage is a frequent symptom, but the bleeding is rarely profuse; more commonly there is slight oozing, and the blood is mixed with, or altered by the secretions, and when vomited the material is dark brown or black, the so-called "coffee-ground" vomit. This is present in a considerable proportion of all cases of cancer, and is an important indication. The blood can be recognized by the microscope as shells of the red blood-corpuscles and irregular masses of altered blood pigment. In cases of doubt the spectroscope may be employed or hæmin crystals obtained.

Fragments of the tumor are rarely found in the vomit, and of the numerous specimens which I have had occasion to examine I have never been able to satisfy myself of the existence of cancerous tissue. As Rosenbach states, in the material washed out with the stomach-tube undoubted fragments may be found. The yeast fungus, various bacteria, and the sarcina ventriculi may be present, the latter not so often in cancer as in dilatation.

Great stress has been laid of late years upon the absence of free hydrochloric acid in the secretions. As an outcome of the enormous number of observations which have recently been made it may be said that free hydrochloric acid is absent in a majority of cases of cancer of the stomach. This defect is associated with impairment of the secreting function of the organ. The examination should be made repeatedly, by the methods already referred to, and with our present knowledge the persistent absence of free HCl in the stomach contents, taken in conjunc-

tion with other symptoms, may be regarded as highly suggestive of cancer. Unfortunately, the free acid may be absent in certain other conditions, such as atrophy, and occasionally in chronic gastritis, so that it is of greater value from the negative standpoint. As Kinnicutt expresses it, "the presence of free HCl in the stomach contents in repeated examinations in doubtful cases is of the greatest diagnostic value, and points very certainly to absence of cancer." Rosenheim has recently shown that in cases in which cancer develops in the base of an old ulcer HCl may be present throughout the course.

Pain is an early and important symptom. It is very variable in situation, and while most common in the epigastrium, it may be referred to the shoulders, the back, or the loins. The pain is described as dragging, burning, or gnawing in character, and very rarely occurs in severe paroxysms of gastralgia, as in gastric ulcer. As a rule, the pain is aggravated by taking food. There is usually marked tenderness on pressure in the epigastric region. It is, however, remarkable how many cases run a painless course.

The *physical examination* of the abdomen reveals in many instances the presence of a tumor. Inspection may show a nodular mass in the epigastrium, or the outlines of a dilated stomach, with peristaltic action. In the palpation of the stomach it is important to bear in mind certain anatomical points. At least two thirds of the organ lie in the left hypochondrium beneath the ribs, and so are practically out of reach. The pyloric orifice lies to the right of the median line, particularly when the stomach is full, in which case it may be reached. It is about on a level with the inner extremity of the eighth right costal cartilage. The pylorus is movable and changes considerably in position with the distention of the stomach. Practically, in health there is available for palpation only a part of the anterior surface of the stomach and the pylorus, which is sometimes, but not always, overlapped by the liver. Tumors limited to the cardia, even when extensive, cannot be felt at all. Tumors involving the fundus, the posterior wall, and the greater part of the lesser curvature cannot be detected unless very large. Tumors of the pylorus, of the anterior wall, and of a large part of the greater curvature are in accessible situations. In the examination the knees should be drawn up, and the patient asked to relax the abdominal walls as much as possible. Sometimes, when nothing can be felt on quiet breathing, a deep inspiration will force down the stomach and bring a tumor mass within reach. Examination should also be made in the knee-elbow position. Cancerous tumors of the stomach are usually felt in the epigastric region, but a mass at the pylorus may be felt in the umbilical region, or, in cases of extreme mobility, in a hypochondriac region, or, very exceptionally, low down in the iliac region. The tumor is usually firm, hard, nodular, and painful on pressure. At the pylorus the mass may be rounded, ball-like, and readily grasped. Gas may sometimes be felt

much importance has been laid by Boas and others on the presence of lactic acid as a diagnostic sign in cancer of the stomach, and in this country D. D. Stewart and J. Friedenwald have published corroborative statements. It may occur early before a tumor is palpable.

bubbling through it. Communicated pulsation from the aorta is not at all uncommon. Inflation of the stomach with gas is often a valuable aid in diagnosis. A teaspoonful of bicarbonate of soda is first given in water, followed by the same amount of tartaric acid. The distention of the stomach which follows may suffice to bring tumor masses into reach.

Careful examination should be made to determine the presence of secondary cancer of the liver or involvement of the lymph glands in the groins or in the supraclavicular spaces. As already mentioned, the development of nodules about the navel may give an important hint, or there may be signs of secondary involvement of the peritonæum.

Intestinal symptoms are not very common. Constipation is more frequently present than diarrhœa, which may, however, set in and prove obstinate toward the end. When there is much bleeding the stools may be dark in color.

A progressive *anæmia* is one of the most striking features of gastric cancer. As a rule the blood-count does not fall below fifty per cent. A leucocytosis is almost constantly present, and Welch has noted an instance in which the ratio of white to red corpuscles was one to twenty. There are instances in which the clinical picture is rather that of a pernicious anæmia, with reduction of the red blood-corpuscles to twenty-five per cent and marked poikilocytosis. When any degree of anæmia is present nucleated red corpuscles may be found in dried and stained specimens, and this method of examination may be of much service when an actual blood-count is impossible. The condition is, however, an anæmia with wasting, and the layer of panniculus is not retained as in the ordinary forms of pernicious anæmia. Ultimately the patient develops an aspect to which the term cachectic is applied, and which is perhaps more marked in gastric cancer than in any other disease. There may be a slight yellowish tint to the skin, and it is not uncommon to see brownish stains, the cachectic chloasma.

Associated with the anæmia and directly dependent upon it are the dropsical symptoms so common in this affection. Œdema of the ankles and of the legs is present and may progress to a general anasarca; the cases may be mistaken for heart-disease or dropsy. There are no special cardiac symptoms; the pulse becomes rapid and feeble toward the end. The anæmia may, however, produce such palpitation and dyspnœa that the case may be regarded as cardiac. Thrombosis of a femoral vein may occur.

The urine may contain a trace of albumen and, toward the close, tube-casts. Indican is often present in increased quantity, and occasionally acetone and diacetic acid.

The temperature is usually normal, and toward the end, when cachexia is well marked, subnormal. There are, however, interesting paroxysmal elevations of temperature, definite chills with fever, in which the thermometer registers 103° or 104°, followed by profuse sweating. The rigors

may recur at intervals for weeks, and, if no tumor is felt, may complicate the diagnosis. In a case at the Philadelphia Hospital the paroxysms recurred for more than six weeks. The autopsy showed a cancer of the stomach with adhesions to the colon and extensive suppuration at the base of the cancer and in a pocket between the stomach and omentum.

The mind usually remains clear to the close. Naturally the patient has attacks of despondency. Toward the close delirium is common. A form of coma resembling that which occurs in diabetes is occasionally met with in gastric cancer. The patient becomes restless or excited, and gradually unconsciousness supervenes, with or without dyspnœa. It is due to the presence of some toxic agent in the blood, possibly the diacetic acid.

Among symptoms referable to the development of secondary growths those pertaining to the liver are most important. Jaundice is not uncommon, and there may be signs of great enlargement of the liver. Many instances which are clinically recorded as primary cancer of this organ are in reality secondary to latent cancer of the stomach. The importance of enlargement of the supra-clavicular and inguinal glands in gastric cancer has already been emphasized. The new growths may extend to the peritonæum and, if there is much effusion, produce ascites. Reference has been made to the perforations liable to occur in gastric cancer. The course of the disease is progressively downward. In the majority of all cases death occurs within two years, and the average duration is not more than eighteen months. In cases of scirrhus the progress is slower.

Diagnosis.—When a tumor is present there is not much difficulty in determining the nature of the trouble; even in its absence the progressive emaciation, the loss of energy and strength, the anæmia and cachexia, when associated with marked gastric symptoms, are almost pathognomonic. There are many instances, however, in which a positive diagnosis is impossible. The diseases with which cancer is most liable to be confounded are ulcer and chronic gastric catarrh, and the differential features are so well drawn in the elaborate article by my colleague Welch that I here append them:*

GASTRIC CANCER.	GASTRIC ULCER.	CHRONIC CATARRHAL GASTRITIS.
1. Tumor is present in three fourths of the cases.	1. Tumor rare.	1. No tumor.
2. Rare under forty years of age.	2. May occur at any age after childhood. Over one half of the cases under forty years of age.	2. May occur at any age.

* *Op. cit.*, vol. ii, p. 570.

End

GASTRIC CANCER.	GASTRIC ULCER.	CHRONIC CATARRHAL GASTRITIS.
3. Average duration about one year, rarely over two years.	3. Duration indefinite; may be for several years.	3. Duration indefinite.
4. Gastric hæmorrhage frequent, but rarely profuse; most common in the cachectic stage.	4. Gastric hæmorrhage less frequent than in cancer, but oftener profuse; not uncommon when the general health is but little impaired.	4. Gastric hæmorrhage rare.
5. Vomiting often has the peculiarities of that of dilatation of the stomach.	5. Vomiting rarely referable to dilatation of the stomach, and then only in a late stage of the disease.	5. Vomiting may or may not be present.
6. Free hydrochloric acid usually absent from the gastric contents in cancerous dilatation of the stomach.	6. Free hydrochloric acid usually present in the gastric contents.	6. Free hydrochloric acid may be present or absent.
7. Cancerous fragments may be found in the washings from the stomach or in the vomit (rare).	7. Absent.	7. Absent.
8. Secondary cancers may be recognized in the liver, the peritonæum, the lymphatic glands, and rarely in other parts of the body.	8. Absent.	8. Absent.
9. Loss of flesh and strength and development of cachexia usually more marked and more rapid than in ulcer or in gastritis, and less explicable by the gastric symptoms.	9. Cachectic appearance usually less marked and of later occurrence than in cancer, and more manifestly dependent upon the gastric disorders.	9. When uncomplicated, usually no appearance of cachexia.
10. Epigastric pain is often more continuous, less dependent upon taking food, less re	10. Pain is often more paroxysmal, more influenced by taking food, oftener relieved	10. The pain or distress induced by taking food is usually less severe than in cancer or

GASTRIC CANCER.	GASTRIC ULCER.	CHRONIC CATARRHAL GASTRITIS.
lieved by vomiting, and less localized than in ulcer.	by vomiting, and more sharply localized than in cancer.	ulcer. Fixed point of tenderness usually absent.
11. Causation not known.	11. Causation not known.	11. Often referable to some known cause, such as abuse of alcohol, gormandizing, and certain diseases, as phthisis, Bright's disease, cirrhosis of the liver, etc.
12. No improvement, or only temporary improvement, in the course of the disease.	12. Sometimes a history of one or more previous similar attacks. The course may be irregular and intermittent. Usually marked improvement by regulation of diet.	12. May be a history of previous similar attacks. More amenable to regulation of diet than is cancer.

Treatment.—The disease is incurable and palliative measures are alone indicated. The diet should consist of readily digested substances of all sorts. Many patients do best on milk alone. Washing out of the stomach, which may be done with a soft tube without any risk, is particularly advantageous when there is obstruction at the pylorus, and is by far the most satisfactory means of combatting the vomiting. The excessive fermentation is also best treated by lavage. When the pain becomes severe, particularly if it disturbs the rest at night, morphia must be given. One eighth of a grain, combined with carbonate of soda (gr. v), bismuth (gr. v–x), usually gives prompt relief, and the dose does not always require to be increased. Creosote (♏ j–ij) and carbolic acid are very useful. The bleeding in gastric cancer is rarely amenable to treatment. Operative measures have been advised and practised, and in exceptional instances there are cases in which the limited cancer could be resected with reasonable hope of recovery.

Non-cancerous tumors of the stomach rarely cause inconvenience. *Polypi* are common and they may be numerous; as many as one hundred and fifty have been reported in one case. *Sarcomata* are very rare. *Fibromata* and *lipomata* have been described.

Foreign bodies occasionally produce remarkable tumors of the stomach. The most extraordinary is the hair tumor, of which a number of instances have been reported in hysterical women who have been in the habit of eating their own hair. A specimen in the medical museum of

Polyadenomata

There is a form in which the adenomata exist as an extensive area slightly raised above the level of the mucous polyadenome en nappe of the French.

McGill University is in two sections, which form an exact mould of the stomach. The tumors which they form are large and very puzzling and have been mistaken for cancer. In one instance the ball of hair was removed by a surgical operation. The tumor was thought to be a movable kidney.

VIII. HÆMORRHAGE FROM THE STOMACH (*Hæmatemesis*).

Etiology.—Gastrorrhagia, as this symptom is called, may result from many conditions, some of which are local, others general.

1. In local disease in the stomach itself: (*a*) Cancer; (*b*) ulcer; (*c*) disease of the blood-vessels, such as miliary aneurisms of the smaller arteries, and occasionally varicose veins; (*d*) acute congestion, as in gastritis, and possibly in vicarious hæmorrhage, but both of these are extremely rare causes.

2. Passive congestion due to obstruction in the portal system. This may be either (*a*) hepatic, as in cirrhosis of the liver, thrombosis of the portal vein, or pressure upon the portal vein by tumor, and secondarily in cases of chronic disease of the heart and lungs; (*b*) splenic. Gastrorrhagia is by no means an uncommon symptom in enlarged spleen, and is explained by the intimate relations which exist between the vasa brevia and the splenic circulation.

3. Toxic: (*a*) The poisons of the specific fevers, small-pox, measles, yellow fever; (*b*) poisons of unknown origin, as in acute yellow atrophy and in purpura; (*c*) phosphorus.

4. Traumatism: (*a*) Mechanical injuries, such as blows and wounds, and occasionally by the stomach-tube; (*b*) the result of severe corrosive poisons.

5. Certain constitutional diseases: (*a*) Hæmophilia; (*b*) profound anæmias, whether idiopathic or due to splenic enlargements or to malaria; (*c*) cholæmia.

6. In certain nervous affections, particularly hysteria, and occasionally in progressive paralysis of the insane and epilepsy.

7. The blood may not come from the stomach, but flow into it. Thus it may pass from the nose or the pharynx. In hæmoptysis some of the blood may find its way into the stomach. The bleeding may take place from the œsophagus and trickle into the stomach, from which it is ejected. This occurs in the case of rupture of aneurism and of the œsophageal varices. A child may draw blood with the milk from the mother's breast even in considerable quantities and then vomit it.

8. Miscellaneous causes: Aneurism of the aorta or of its branches may rupture into the stomach. There are instances in which a patient has a single attack of hæmorrhage without even having a recurrence or without symptoms pointing to disease of the stomach.

In new-born infants hæmorrhage may occur within the first two weeks and prove rapidly fatal; the precise etiology of this is not known. This *melæna neonatorum*, according to Hecker, occurs in one of every five hundred infants. In a few instances it seems to be associated with an acquired or hereditary hæmophilia. Occasionally it is met with in sound, healthy infants; in others the birth has been premature, and in such cases the bleeding may be associated with premature interruption of the fœtal circulation. In very exceptional cases ulcer of the stomach has been found.

In medical practice, hæmorrhage from the stomach occurs most frequently in connection with cirrhosis of the liver and ulcer of the stomach. It is more frequent in women than in men, owing to the greater prevalence of round ulcer in the former.

Morbid Anatomy.—When death has occurred from the hæmatemesis there are signs of intense anæmia. The condition of the stomach varies extremely. The lesion is evident in cancer and in ulcer of the stomach. It is to be borne in mind that fatal hæmorrhage may come from a small miliary aneurism communicating with the surface by a pinhole perforation, or the bleeding may be due to the rupture of a submucous vein and the erosion in the mucosa may be small and readily overlooked. It may require a careful and prolonged search to avoid overlooking such lesions. In the large group associated with portal obstruction, whether due to hepatic or splenic disease, the mucosa is usually pale, smooth, and shows no trace of any lesion. In cirrhosis, fatal by hæmorrhage, one may sometimes search in vain for any focal lesion to account for the gastrorrhagia, and we must conclude that it is possible for even the most profuse bleeding to occur by diapedesis. The stomach may be distended with blood and the source of the hæmorrhage not apparent either in the stomach or in the the portal system. In such cases the œsophagus should be examined, as the bleeding may come from that source. In toxic cases there are invariably hæmorrhages in the mucous membrane itself.

Symptoms.—In rare instances fatal syncope may occur without any vomiting. In a case of the kind, in which the woman had fallen over and died in a few minutes, the stomach contained between three and four pounds of blood. The sudden profuse bleedings rapidly lead to profound anæmia. When due to ulcer or cirrhosis the bleeding usually recurs for several days. Fatal hæmorrhage from the stomach is met with in ulcer, cirrhosis, enlargement of the spleen, and in instances in which an aneurism ruptures into the stomach or œsophagus. Gastrorrhagia may occur in splenic anæmia or in leukæmia before the condition has aroused the attention of friends or physician.

The amount of blood lost is very variable, and in the course of a day the patient may bring up three or four pounds, or even more. In a case under the care of George Ross, in the Montreal General Hospital, the

with bleeding from other membranes
(see Hemorrhages in the new born. p.

patient lost during seven days ten pounds, by measurement, of blood. The usual symptoms of anæmia develop rapidly, and there may be slight fever, and subsequently œdema may occur. An interesting circumstance connected with gastro-intestinal hæmorrhage is the development of amaurosis, the mode of production of which is still under discussion.

Diagnosis.—In a majority of instances there is no question as to the origin of the blood. Occasionally it is difficult, particularly if the case has not been seen during the attack. Examination of the vomit readily determines whether blood is present or not. The materials vomited may be stained by wine, the juice of strawberries, raspberries, or cranberries, which give a color very closely resembling fresh blood, while iron and bismuth and bile may produce a blackish color like altered blood. In such cases the microscope will show clearly the presence of the shadowy outlines of the red blood-corpuscles, and, if necessary, spectroscopic and chemical tests may be applied.

Deception is sometimes practised by hysterical patients, who swallow and then vomit blood or colored liquids. With a little care such cases can usually be detected. The cases must be excluded in which the blood passes from the nose or pharynx, or in which infants swallow it with the milk.

There is not often difficulty in distinguishing between hæmoptysis and hæmatemesis, though the coughing and the vomiting are not infrequently combined. The following are points to be borne in mind in the diagnosis:

HÆMATEMESIS.	HÆMOPTYSIS.
1. Previous history points to gastric, hepatic, or splenic disease.	1. Cough or signs of some pulmonary or cardiac disease precedes, in many cases, the hæmorrhage.
2. The blood is brought up by vomiting, prior to which the patient may experience a feeling of giddiness or faintness.	2. The blood is coughed up, and is usually preceded by a sensation of tickling in the throat. If vomiting occurs, it follows the coughing.
3. The blood is usually clotted, mixed with particles of food, and has an acid reaction. It may be dark, grumous, and fluid.	3. The blood is frothy, bright red in color, alkaline in reaction. If clotted, rarely in such large coagula, and muco pus may be mixed with it.
4. Subsequent to the attack the patient passes tarry stools, and signs of disease of the abdominal viscera may be detected.	4. The cough persists, physical signs of local disease in the chest may usually be detected, and the sputa may be blood-stained for many days.

Prognosis.—Except in the case of rupture of aneurism or of large veins, hæmatemesis rarely proves fatal. In my experience death has fol-

lowed more frequently in cases of cirrhosis and splenic enlargement than in ulcer or cancer. In ulcer it is to be remembered that in the chronic hæmorrhagic form the bleeding may recur for years. The treatment of hæmatemesis is considered under gastric ulcer.

VII. DISEASES OF THE INTESTINES.

I. DISEASES OF THE INTESTINES ASSOCIATED WITH DIARRHŒA.

CATARRHAL ENTERITIS; DIARRHŒA.

In the classification of catarrhal enteritis the anatomical divisions of the bowel have been too closely followed, and a duodenitis, jejunitis, ileitis, typhlitis, colitis, and proctitis have been recognized; whereas in a majority of cases the entire intestinal tract, to a greater or lesser extent, is involved, sometimes the small most intensely, sometimes the large bowel, but during life it may be quite impossible to say which portion is specially affected.

Etiology.—The causes may be either *primary* or *secondary*. Among the causes of *primary* catarrhal enteritis are: (*a*) Improper food, one of the most frequent, especially in children, in whom it follows overeating, or the ingestion of unripe fruit. In some individuals special articles of diet will always produce a slight diarrhœa, which may not be due to a catarrh of the mucosa, but to increased peristalsis induced by the offending material. (*b*) Various toxic substances. Many of the organic poisons, such as those produced in the decomposition of milk and articles of food, excite the most intense intestinal catarrh. Certain inorganic substances, as arsenic and mercury, act in the same way. (*c*) Changes in the weather. A fall in the temperature of from twenty to thirty degrees, particularly in the spring or autumn, may induce—how, it is difficult to say—an acute diarrhœa. We speak of this as a catarrhal process, the result of cold or of chill. On the other hand, the diarrhœal diseases of children are associated in a very special way with the excessive heat of summer months. (*d*) Changes in the constitution of the intestinal secretions. We know too little about the *succus entericus* to be able to speak of influences induced by change in its quantity or quality. It has long been held that an increase in the amount of bile poured into the bowel might excite a diarrhœa; hence the term bilious diarrhœa, so frequently used by the older writers. Possibly there are conditions in which an excessive amount of bile is poured into the intestine, increasing the peristalsis, and hurrying on the contents; but the opposite state, a scanty secretion, by favoring the natural fermentative processes, much more commonly causes an intestinal catarrh. Absence of the pancreatic secretion from the intestine has been associated

in certain cases with a fatty diarrhœa. (*e*) Nervous influences. It is by no means clear how mental states act upon the bowels, and yet it is an old and trustworthy observation which every-day experience confirms that the mental state may profoundly affect the intestinal canal. These influences should not properly be considered under catarrhal processes, as they result simply from increased peristalsis or increased secretion, and are usually described under the heading *nervous diarrhœa.* In children it frequently follows fright. It is common, too, in adults as a result of emotional disturbances. Canstatt mentions a surgeon who always before an important operation had watery diarrhœa. In hysterical women it is seen as an occasional occurrence, due to transient excitement, or as a chronic, protracted diarrhœa, which may last for months or even years.

Among the *secondary* causes of intestinal catarrh may be mentioned: (*a*) Infectious diseases. Dysentery, cholera, typhoid fever, pyæmia, septicæmia, tuberculosis, and pneumonia are occasionally associated with intestinal catarrh. In dysentery and typhoid fever the ulceration is in part responsible for the catarrhal condition, but in cholera it is probably a direct influence of the bacilli or of the toxic materials produced by them. (*b*) The extension of inflammatory processes from adjacent parts. Thus, in peritonitis, catarrhal swelling and increased secretion are always present in the mucosa. In cases of invagination, hernia, tuberculous or cancerous ulceration, catarrhal processes are common. (*c*) Circulatory disturbances cause a catarrhal enteritis, usually of a very chronic character. This is common in diseases of the liver, such as cirrhosis, and in chronic affections of the heart and lungs—all conditions, in fact, which produce engorgement of the terminal branches of the portal vessels. (*d*) In the cachectic conditions met with in cancer, profound anæmia, Addison's disease, and Bright's disease intestinal catarrh may develop, and may terminate life.

Morbid Anatomy.—Changes in the mucous membrane are not always visible, and in cases in which, during life, the symptoms of intestinal catarrh have been marked, neither redness, swelling, nor increased secretion—the three signs usually laid down as characteristic of catarrhal inflammation—may be present post mortem. It is rare to see the mucous membrane injected; more commonly it is pale and covered with mucus. In the upper part of the small intestine the tips of the valvulæ conniventes may be deeply injected. Even in extreme grades of portal obstruction intense hyperæmia is not often seen. The entire mucosa may be softened and infiltrated, the lining epithelium swollen, or even shed, and appearing as large flakes among the intestinal contents. This is, no doubt, a post-mortem change. The lymph follicles are almost always swollen, particularly in children. The Peyer's patches may be prominent and the solitary follicles in the large and small bowel may stand out with distinctness and present in the centres little erosions, the so-called follicular ulcers. This may be a striking feature in the intestine in all forms of catarrhal enteritis in children, quite irrespective of the intensity of the diarrhœa.

When the process is more chronic the mucosa is firmer, in some instances thickened, in others distinctly thinned, and the villi and follicles present a slaty pigmentation.

Symptoms.—Acute and chronic forms may be recognized. The important symptom of both is diarrhœa, which, in the majority of instances, is the sole indication of this condition. It is not to be supposed that diarrhœa is invariably caused by, or associated with, catarrhal enteritis, as it may be produced by nervous and other influences. It is probable that catarrh of the jejunum may exist without any diarrhœa; indeed, it is a very common circumstance to find post mortem a catarrhal state of the small bowel in persons who have not had diarrhœa during life. The stools vary extremely in character. The color depends upon the amount of bile with which they are mixed, and they may be of a dark or blackish brown, or of a light-yellow, or even of a grayish-white tint. The consistence is usually very thin and watery, but in some instances the stools are pultaceous like thin gruel. Portions of undigested food can often be seen (lienteric diarrhœa), and flakes of yellowish-brown mucus. Microscopically there are innumerable micro-organisms, epithelium and mucous cells, crystals of phosphate of lime, oxalate of lime, and occasionally cholesterin and Charcot's crystals.

Pain in the abdomen is usually present in the acute catarrhal enteritis, particularly when due to food. It is of a colicky character, and when the colon is involved there may be tenesmus. More or less tympanites exists, and there are gurgling noises or borborygmi, due to the rapid passage of fluid and gas from one part to another. In the very acute attacks there may be vomiting. Fever is not, as a rule, present, but there may be a slight elevation of one or two degrees. The appetite is lost, there is intense thirst, and the tongue is dry and coated. In very acute cases, when the quantity of fluid lost is great and the pain excessive, there may be collapse symptoms. The number of evacuations varies from four or five to twenty or more in the course of the day. The attack lasts for two or three days, or may be prolonged for a week or ten days.

Chronic catarrh of the bowels may follow the acute form, or may develop gradually as an independent affection or as a sequence of obstruction in the portal circulation. It is characterized by diarrhœa, with or without colic. The dejections vary; when the small bowel is chiefly involved the diarrhœa is of a lienteric character, and when the colon is affected the stools are thin and mixed with much mucus. A special form of mucous diarrhœa will be subsequently described. The general nutrition of the patient in these chronic cases is greatly disturbed; there may be much loss of flesh and great pallor. The patients are inclined to suffer from low spirits, or hypochondriasis may develop.

Diagnosis.—It is important, in the first place, to determine, if possible, whether the large or small bowel is chiefly affected. In catarrh of the small bowel the diarrhœa is less marked, the pains are of a colicky

character, borborygmi are not so frequent, the fæces usually contain portions of food, and are more yellowish-green or grayish-yellow and flocculent and do not contain much mucus. When the large intestine is at fault there may be no pain whatever, as in the catarrh of the large intestine associated with tuberculosis and Bright's disease. When present, the pains are most intense and, if the lower portion of the bowel is involved, there may be marked tenesmus. The stools have a uniform soupy consistence, grayish in color and granular throughout, with here and there flakes of mucus, or they may contain very large quantities of mucus.

There are no positive symptoms by which the diagnosis of duodenitis can be made. It is usually associated with acute gastritis and, if the process extends into the bile-duct, with jaundice. Neither jejunitis nor ileitis can be separated from general intestinal catarrh.

ENTERITIS IN CHILDREN.

We may recognize three forms: (1) The acute dyspeptic diarrhœa; (2) cholera infantum; and (3) acute entero-colitis.

General Etiology of the Diarrhœas of Children.—The disease is most frequent in artificially fed children, and the greatest number of cases occur between the ages of six and eighteen months. A popular and well-founded belief ascribes special danger to the second summer of the infant. Infantile diarrhœa is very prevalent among the poorer classes in the large cities. It attacks, however, children with the most favorable surroundings. Two factors influence the disease, diet and temperature. An immense majority of all fatal cases are artificially fed. Of 1,943 fatal cases in Holt's statistics, only three per cent were exclusively breast fed. Among the poor the bowel complaint in children begins with the artificial feeding. The relation of temperature to the prevalence of diarrhœal diseases in children has long been recognized. The mortality curve begins to rise in May, increases in June, reaches the maximum in July, and gradually sinks through August and September. The maximum corresponds closely with the highest mean temperature; yet we cannot regard the heat itself as the direct agent, but only one of several factors. Thus the mean temperature of June is only four or five degrees lower than that of July, and yet the mortality is not more than one third. Seibert, who has carefully analyzed the mortality and the temperature, month by month, in New York, for ten years, fails to find a constant relation between the degree of heat and the number of cases of diarrhœa. Neither barometric pressure nor humidity appears to have any influence.

Relation of Bacteria.—The healthy fæces of sucklings contain a number of bacteria and micrococci, the most important of which are the *bacterium lactis aerogenes* and the *bacterium coli commune*. The former is only present in the intestine after a milk diet, the milk sugar appearing to furnish the materials necessary for its growth. It occurs more

in the upper portion of the bowel, and in this region excites the fermentative processes in the milk. The *bacterium coli commune* is found more abundantly in the lower portion of the small intestine and in the colon, and excites fermentative changes which are probably associated with certain phases of digestion. The observations of Escherich show the remarkable simplicity of this bacterial vegetation in the healthy fæces of milk-fed children, as these two alone develop and are constant. In infantile diarrhœa the number of bacteria which may be isolated from the stools is remarkable. Booker has discriminated forty varieties, the greatest number of which were found in the cases of cholera infantum. The two constant forms noted above do not disappear in the diarrhœal stools. No forms have been found to bear a constant or specific relation to the diarrhœal fæces, such as the two above mentioned do to the healthy milk fæces. The bacteria of the *proteus* group are most frequent, and possess pathogenic properties. All the varieties develop and produce important changes in the milk, which have been dealt with very fully by Booker in his studies. This author concludes that in the diarrhœa of infants "not one specific kind, but many different kinds of bacteria are concerned, and that their action is manifested more in the alteration of the food and intestinal contents and in the production of injurious products than in a direct irritation upon the intestinal wall." With these agree the conclusions of Jeffries and Baginsky regarding cholera infantum.

Morbid Anatomy.—We find most frequently a catarrhal swelling of the mucosa of both small and large bowel with enlargement of the lymph follicles. In more chronic cases the latter show small erosions or follicular ulcers; more rarely there is croupous enteritis affecting the lower part of the ileum and the colon. The changes in the other organs are neither numerous nor characteristic. Broncho-pneumonia occurs in many cases. The spleen may be swollen. Brain lesions are rare; the membranes and substance are often anæmic, but meningitis or thrombosis is very uncommon.

Clinical Forms.—Acute Dyspeptic Diarrhœa.—The child may appear in its usual health, but has an increase in the number of stools, without fever or special disturbance except slight restlessness at night. After persisting for a day or two the stools become more frequent and contain undigested food and curds, and are very offensive. In other cases the disease sets in abruptly with vomiting, griping pains, and fever, which may rise rapidly and reach 104° or 105°. There may be convulsions at the outset. The abdomen is sensitive, and the child lies with the legs drawn up. The stools consist of grayish or greenish-yellow fæces mixed with gas, curds, and portions of food. In children over two years of age such attacks not infrequently follow eating freely of unripe fruit or the drinking of milk which has been tainted. With judicious treatment the children improve in a few days; but relapses are not uncommon, and in the hot weather the attack may be the starting point of a severe entero-colitis. In a de-

bilitated child a mild attack may prove fatal. This dyspeptic diarrhœa is distinguished sharply from cholera infantum by the character of the stools, which never have a watery, serous character. In many instances this form precedes the onset of the specific fevers, particularly during the hot weather.

Cholera Infantum.—This is the counterpart in the infant of the so-called choleraic diarrhœa in the adult, and in their clinical aspects these two forms are identical. It is by no means so common as the ordinary dyspeptic diarrhœa of children, and, according to Holt, occurs only in two or three per cent of the cases of summer diarrhœa. It prevails in the hot weather and in children artificially fed or who have had previously some slight dyspeptic derangement. It is characterized by vomiting, uncontrollable diarrhœa, and collapse. The disease sets in with vomiting, which is incessant and is excited by any attempt to take food or drink. The stools are profuse and frequent; at first fæcal in character, brown or yellow in color, and finally thin, serous, and watery. The stools first passed are very offensive; subsequently they are odorless. The thin, serous stools are alkaline. There is fever, but the axillary temperature may register three or more degrees below that of the rectum. From the outset there is marked prostration; the eyes are sunken, the features pinched, the fontanelle depressed, and the skin has a peculiar ashy pallor. At first restless and excited, the child subsequently becomes heavy, dull, and listless. The tongue is coated at the onset, but subsequently becomes red and dry. As in all choleraic conditions, the thirst is insatiable; the pulse is rapid and feeble, and toward the end becomes irregular and imperceptible. Death may occur within twenty-four hours, with symptoms of collapse and great elevation of the internal temperature. Before the end the diarrhœa and vomiting may cease. In other instances the intense symptoms subside, but the child remains torpid and semi-comatose with fingers clutched, and there may be convulsions. The head may be retracted and the respirations interrupted, irregular, and of the Cheyne-Stokes type. The child may remain in this condition for some days without any signs of improvement. It was to this group of symptoms in infantile diarrhœa that Marshall-Hall gave the term "hydrencephaloid" or spurious hydrocephalus. As a rule, no changes in the brain or other organs are found, and the condition is no doubt caused by the toxic agents absorbed from the intestine. A remarkable condition of sclerema is described as a sequel of cholera infantum. The skin and subcutaneous tissues become hard and firm and the appearance has been compared to that of a half-frozen cadaver.

No constant organism has been found in these cases. Baginsky considers the disease the result of the action on the system of the poisonous products of decomposition encouraged by the various bacteria present—a *fäulniss* disease. The clinical picture is that produced by an acute bacterial infection, as in Asiatic cholera.

The *diagnosis* is readily made. There is no other intestinal affection in children for which it can be mistaken. The constant vomiting, the frequent watery discharges, the collapse symptoms, and the elevated temperature make an unmistakable clinical picture. The outlook in the majority of cases is bad, particularly in children artificially fed. Hyperpyrexia, extreme collapse, and incessant vomiting are the most serious symptoms.

Acute Entero-colitis.—In this form the ileum and colon are most affected, chiefly in the lymph follicles, hence the term follicular enteritis or follicular dysentery. It occurs most frequently in warm weather, in artificially fed children; but it may set in at any season of the year, and is the form of enteritis most common as a secondary complication in the specific fevers of childhood.

The attack may follow the ordinary dyspeptic diarrhœa. The temperature increases, the stools change in character and contain traces of blood and mucus, the former usually only in streaks. The fæces are passed without any pain. The abdomen is distended and tender along the line of the colon. Vomiting may be present at the outset, but is not a characteristic feature, as in cholera infantum. The diarrhœa may be gradually checked and convalescence is established in two or three weeks; in other instances the disease becomes subacute, the fever subsides, but the diarrhœa persists and the general health of the child rapidly deteriorates. The case may drag on for five or six weeks, when improvement gradually occurs or the child is carried off by a severe intercurrent attack. In a third form of acute entero-colitis, in which anatomically the lesions are those already mentioned—namely, an intense follicular inflammation—the symptoms are of a more severe character, and the affection is sometimes spoken of as acute dysentery. It attacks children up to the third or fourth year or even older. The onset is sudden, with high fever, vomiting, frequent stools, which at first contain remnants of food and fæces and subsequently much mucus and some blood. There is incessant pain, which may be more severe than in any intestinal affection of childhood. The prostration is very great and the fatal termination may occur within forty-eight hours. More commonly the case lasts for a week or longer. In two cases of this sort, in one of which death occurred in forty-eight and in the other in sixty-four hours, the anatomical characters were those of the most acute follicular enteritis, characterized by great swelling of the lymph follicles, some of which already presented necrotic foci.

The Cœliac Affection.—Under this heading Gee has described an intestinal disorder, most commonly met with in children between the ages of one and five, characterized by the occurrence of pale, loose stools, not unlike gruel or oatmeal porridge. They are bulky, not watery, yeasty, frothy, and extremely offensive. The affection has received various names, such as *diarrhœa alba* or *diarrhœa chylosa*. It is not associated with tuberculosis or other hereditary disease. It begins insidiously and there

See Lancet for Oct. 6th.

in many conditions, to wit:-

and lastly it is possible that in some cases of ulcerative colitis in chronic disease we see the terminal state of a diphtheritic process

are progressive wasting, weakness, and pallor. The belly becomes doughy and inelastic. There is often flatulency. Fever is usually absent. The disease is lingering and a fatal termination is common. So far nothing is known of the pathology of the disease. Ulceration of the intestines has been met with, but it is not constant. This affection resembles somewhat the disease in adults known as the *hill diarrhœa*, or the white flux of India; but certain of these tropical diarrhœas are, as will be mentioned, associated with the presence of the *anchylostoma*.

DIPHTHERITIC OR CROUPOUS ENTERITIS.

~~There are many conditions in which~~ an intense croupous or diphtheritic inflammation of the mucosa of the small and large intestines occurs. ~~It is met with most frequently~~ (*a*) as a secondary process in the infectious diseases—pneumonia, pyæmia in its various forms, and typhoid fever; (*b*) as a terminal process in many chronic affections, such as Bright's disease, cirrhosis of the liver, or cancer; and (*c*) as an effect of certain poisons—mercury, lead, and arsenic.

The disease presents three different anatomical pictures. In one group of cases the mucosa presents on the top of the folds a thin grayish-yellow diphtheritic exudate situated upon a deeply congested base. In some cases all grades may be seen between the thinnest film of superficial necrosis and involvement of the entire thickness of the mucosa. In the colon similar transversely arranged areas of necrosis are seen situated upon hypæramic patches, and it may be here much more extensive and involve a large portion of the membrane. There may be most extensive inflammation without any involvement of the solitary follicles of the large or small bowel.

In a second group of cases the membrane has rather a croupous character. It is grayish white in color, more flake-like and extensive, limited, perhaps, to the cæcum or to a portion of the colon; thus, in several cases of pneumonia I found this flaky adherent false membrane, in one instance forming patches 1 to 2 cm. in diameter, which were not unlike in form to rupia crusts.

In a third group the affection is really a follicular enteritis, involving the solitary glands, which are swollen and capped with an area of diphtheritic necrosis or are in a state of suppuration. Follicular ulcers are common in this form. The disease may run its course without any symptoms, and the condition is unexpectedly met with post mortem. In other instances there are diarrhœa, pain, but not often tenesmus or the passage of blood-stained mucus. In the toxic cases the intestinal symptoms may be very marked, but in the terminal colitis of the fevers and of constitutional affections the symptoms are often trifling.

PHLEGMONOUS ENTERITIS.

As an independent affection this is excessively rare, even less frequent than its counterpart in the stomach. It is seen occasionally in connection with intussusception, strangulated hernia, and chronic obstruction. Apart from these conditions it occurs most frequently in the duodenum, and leads to suppuration in the submucosa and abscess formation. Except when associated with hernia or intussusception the affection cannot be diagnosed. The symptoms usually resemble those of peritonitis.

MUCOUS COLITIS.

This affection is known by various names, such as *membranous enteritis*, *tubular diarrhœa*, and *mucous colic*. It is a remarkable disease, to which much attention has been paid for several centuries. An exhaustive description of it is given by Woodward, in Vol. II of the Medical and Surgical Reports of the Civil War. It is an affection of the large bowel, characterized by the production of a very tenacious adherent mucus, which may be passed in long strings or as a continuous, tubular membrane. I have twice had opportunities of seeing this membrane *in situ*, closely adherent to the mucosa of the colon, but capable of separation without any lesion of the surface. Judging from the statement of English authors as to its rarity, it would appear to be a more frequent disease in this country. According to W. A. Edwards, 80 per cent of the recorded adult cases have been in women. It occurs occasionally in children. Of 111 cases six were under the age of ten. The cases are almost invariably seen in nervous or hysterical women or in men with neurasthenia. All grades of the affection occur, from the passage of a slimy mucus, like frog-spawn, to large tubular casts a foot or more in length. Microscopically the casts are, as shown by Sir Andrew Clark, not fibrinous, but mucoid, and even the firmest consist of dense, opaque, transformed mucus. It is due to a derangement of the mucous glands of the colon, the nature of which is quite unknown.

Symptoms.—The disease persists for years, varying extremely from time to time, and is characterized by paroxysms of pain in the abdomen, tenderness, occasionally tenesmus, and the passage of flakes or long strings of mucus, sometimes of definite casts of the bowel. The attacks last for a day or, in some instances, for ten days or two weeks. Mental emotions and worry of any sort seem particularly apt to bring on an attack. Occasionally errors in diet or dyspepsia precede an outbreak. Membranes are not passed with every paroxysm, even when the pains and cramps are severe. There are instances in which the morphia habit has been contracted on account of the severity of the pain. There may be marked nervous symptoms, and authors mention hysterical outbreaks, hypochondriasis, and melancholia.

The cases have been mistaken for appendicitis and I have known the appendix to be removed

Dr Kenwin has called attention to described what he calls albuminuric exudation of the bowels in cases of embraded kidneys. The lesions were usually fatal & often brought about a fatal issue by causing peritonitis. Among symptoms present were sinking pains, tenderness, diarrhoea & vomiting (B M J. 1894. p. 65

The *diagnosis* is rarely doubtful, but it is important not to mistake the membranes for other substances; thus, the external cuticle of asparagus and undigested portions of meat or sausage-skins sometimes assume forms not unlike mucous casts, but the microscopical examination will quickly differentiate them.

ULCERATIVE ENTERITIS.

In addition to the specific ulcers of tuberculosis, syphilis, and typhoid fever, the following forms of ulceration occur in the bowels:

(*a*) *Follicular Ulceration.*—As previously mentioned, this is met with very commonly in the diarrhœal diseases of children, and also in the secondary or terminal inflammations in many fevers and constitutional disorders. The ulcers are small, punched out, with sharply cut edges, and they are usually limited to the follicles. With this form may be placed the catarrhal ulcers of some writers.

(*b*) *Stercoral Ulcers*, which occur in long-standing cases of constipation. Very remarkable indeed are the cases in which the sacculi of the colon become filled with rounded small scybala, some of which produce distinct ulcers in the mucous membrane. The fæcal masses may have lime salts deposited in them, and thus form little enteroliths.

(*c*) *Simple Ulcerative Colitis.*—This affection, which clinically is characterized by diarrhœa, is often regarded wrongly as a form of dysentery. It is not a very uncommon affection, and is most frequently met with in men above the middle period of life. The ulceration may be very extensive, so that a large proportion of the mucosa is removed. The lumen of the colon is sometimes greatly increased, and the muscular walls hypertrophied. There are instances in which the bowel is contracted. Frequently the remnants of the mucosa are very dark, even black, and there may be polypoid outgrowths between the ulcers.

These cases rarely come under observation at the outset, and it is difficult to speak of the mode of origin. They are characterized by diarrhœa of a lienteric rather than of a dysenteric character. There is never blood or pus in the stools. Constipation may alternate with the diarrhœa. There is usually great impairment of nutrition, and the patients get weak and sallow. Perforation occasionally occurs.

The disease may prove fatal, or it may pass on and become chronic. The affection was not very infrequent at the Philadelphia Hospital, and though the disease bears some resemblance to dysentery, it is to be separated from it. Some of the cases which we have learned to recognize as amœbic dysentery resemble this form very closely. An excellent description of it is given by Hale White.*

(*d*) *Ulceration from External Perforation.*—This may result from the

* Guy's Hospital Reports, 1888.

erosion of new growths or, more commonly, from localized peritonitis with abscess formation and perforation of the bowel. This is met with most frequently in tuberculous peritonitis, but it may occur in the abscess which follows perforation of the appendix or suppurative or gangrenous pancreatitis. Fatal hæmorrhage may result from the perforation.

(*e*) *Cancerous Ulcers.*—In very rare instances of multiple cancer or sarcoma the submucous nodules break down and ulcerate. In one case the ileum contained eight or ten sarcomatous ulcers secondary to an extensive sarcoma in the neighborhood of the shoulder-joint.

(*f*) Occasionally a *solitary ulcer* is met with in the cæcum or colon, which may lead to perforation. Two instances of ulcer of the cæcum, both with perforation, have come under my observation, and in one instance a simple ulcer of the colon perforated and led to fatal peritonitis.

Diagnosis of Intestinal Ulcers.—As a rule, diarrhœa is present in all cases, but exceptionally there may be extensive ulceration, particularly in the small bowel, without diarrhœa. Very limited ulceration in the colon may be associated with frequent stools. The character of the dejections is of great importance. Pus, shreds of tissue, and blood are the most valuable indications. Pus occurs most frequently in connection with ulcers in the large intestine, but when the bowel alone is involved the amount is rarely great, and the passage of any quantity of pure pus is an indication that it has come from without, most commonly from the rupture of a pericæcal abscess, or in women an abscess of the broad ligament. Pus may also be present in cancer of the bowel, or it may be due to local disease in the rectum. A purulent mucus may be present in the stools in cases of ulcer, but it has not the same diagnostic value. The swollen, sago-like masses of mucus which are believed by some to indicate follicular ulceration are met with also in mucous colitis. Hæmorrhage is an important and valuable symptom of ulcer of the bowel, particularly if profuse. It occurs under so many conditions that taken alone it may not be specially significant, but with other coexisting circumstances it may be the most important indication of all.

Fragments of tissue are occasionally found in the stools in ulcer, particularly in the extensive and rapid sloughing in dysenteric processes. Definite portions of mucosa, shreds of connective tissue, and even bits of the muscular coat may be found. Pain occurs in many cases, either of a diffuse, colicky character, or sometimes, in the ulcer of the colon, very limited and well defined.

Perforation is an accident liable to happen when the ulcer extends deeply. In the small bowel it leads to a localized or general peritonitis. In the large intestine, too, a fatal peritonitis may result, or if perforation takes place in the posterior wall of the ascending or descending colon, the production of a large abscess cavity in the retro-peritonæum. In a case at the University Hospital, Philadelphia, there was a perforation at

the splenic flexure of the colon with an abscess containing air and pus —a condition of subphrenic pyo-pneumothorax.

Treatment of the Previous Conditions.

(*a*) **Acute Dyspeptic Diarrhœa.**—All solid food should be withheld. If vomiting is present ice may be given, and small quantities of milk and soda water may be taken. If the attack has followed the eating of large quantities of undigestible material, castor oil or calomel is advisable, but is not necessary if the patient has been freely purged. If the pain is severe, twenty drops of laudanum and a drachm of spirits of chloroform may be given, or, if the colic is very intense, a hypodermic of a quarter of a grain of morphia. It is not well to check the diarrhœa unless it is profuse, as it usually stops spontaneously within forty-eight hours. If persistent, the aromatic chalk powder or large doses of bismuth (thirty to forty grains) may be given. A small enema of starch (two ounces) with twenty drops of laudanum, every six hours, is a most valuable remedy.

(*b*) **Chronic Diarrhœa,** including chronic catarrh and ulcerative enteritis. It is important, in the first place, to ascertain, if possible, the cause and whether ulceration is present or not. So much in treatment depends upon the careful examination of the stools—as to the amount of mucus, the presence of pus, the occurrence of parasites, and, above all, the state of digestion of the food—that the practitioner should pay special attention to them. Many cases simply require rest in bed and a restricted diet. Chronic diarrhœa of many months' or even of several years' duration may be sometimes cured by strict confinement to bed and a diet of boiled milk and albumen water.

In that form in which immediately after eating there is a tendency to loose evacuations it is usually found that some one article of diet is at fault. The patient should rest for an hour or more after meals. Sometimes this alone is sufficient to prevent the occurrence of the diarrhœa. In those forms which depend upon abnormal conditions in the small intestine, either too rapid peristalsis or faulty fermentative processes, bismuth is indicated. It must be given in large doses—from half a drachm to a drachm three times a day. The smaller doses are of little use. Naphthalin preparations here do much good, given in doses of from ten to fifteen grains (in capsule) four or five times a day. Larger doses may be needed. Salol and the salicylate of bismuth may be tried.

An extremely obstinate and intractable form is the diarrhœa of hysterical women. A systematic rest cure will be found most advantageous, and if a milk diet is not well borne the patient may be fed exclusively on egg albumen. The condition seems to be associated in some cases with increased peristalsis, and in such the bromides may do good, or preparations of opium may be necessary. There are instances which prove most obstinate and resist all forms of treatment, and the patient may be greatly reduced. A change of air and surroundings may do more than medicines.

In a large group of the chronic diarrhœas the mischief is seated in the

colon and is due to ulceration. Medicines by the mouth are here of little value. The stools should be carefully watched and a diet arranged which shall leave the smallest possible residue. Boiled or peptonized milk may be given, but the stools should be examined to see whether there is an excess of food or of curds. Meat is, as a rule, badly borne in these cases. The diarrhœa is best treated by enemata. The starch and laudanum should be tried, but when ulceration is present it is better to use astringent injections. From two to four pints of warm water containing from half a drachm to a drachm of nitrate of silver may be used. In the chronic diarrhœa which follows dysentery this is particularly advantageous. In giving large injections the patient should be in the dorsal position, with the hips elevated, and it is best to allow the injection to flow in gradually from a siphon bag. In this way the entire colon can be irrigated and the patient can retain the injection for some time. The silver injections may be very painful, but they are invaluable in all forms of ulcerative colitis. Acetate of lead, boracic acid, sulphate of copper, sulphate of zinc, and salicylic acid may be used in one per cent solutions.

In mucous colitis no benefit can be expected from remedies administered by the mouth. The topical applications should be made to the mucous membrane of the colon by the enemata just mentioned, and the general nervous condition should receive appropriate treatment.

In the intense forms of choleraic diarrhœa in adults associated with constant vomiting and frequent watery discharges the patient should be given at once a hypodermic of a quarter of a grain of morphia, which should be repeated in an hour if the pains return or the purging persists. This gives prompt relief, and is often the only medicine needed in the attack. The patient should be given stimulants, and, when the vomiting is allayed by suitable remedies, small quantities of milk and lime water.

(*c*) **The Diarrhœa of Children.**—*Hygienic management* is of the first importance. The effect of a change from the hot, stifling atmosphere of a town to the mountains or the sea is often seen at once in a reduction in the number of stools and a rapid improvement in the physical condition. Even in cities much may be done by sending the child into the parks or for daily excursions on the water. However extreme the condition, fresh air is indicated. The child should not be too thickly clad. Many mothers, even in the warm weather, clothe their children too heavily. Bathing is of value in infantile diarrhœa, and when the fever rises above 102·5° the child should be placed in a warm bath, the temperature of which may be gradually reduced, or the child is kept in the bath for twenty minutes, by which time the water is sufficiently cooled. Much relief is obtained by the application of ice-cold cloths or of the ice-cap to the head. Irrigation of the colon with ice-cold water is sometimes favorable, but it has not the advantage of the general bath, the beneficial effect of which is seen, not only in the reduction of the temperature, but in a general stimulation of the nervous system of the child.

Dietetic Treatment.—In the case of a hand-fed child it is important, if possible, to get a wet-nurse. While fever is present, digestion is sure to be much disturbed, and the amount of food should be restricted. If water or barley water be given the child will not feel the deprivation of food so much. When the vomiting is incessant it is much better not to attempt to give milk or other articles of food, but let the child take the water whenever it will.

In the dyspeptic diarrhœas of infants, practically the whole treatment is a matter of artificial feeding, and there is no subject in medicine on which it is more difficult to lay down satisfactory rules. No doubt within a few years the study of the bacterial processes going on in the intestines of the child will give us most important suggestions. From his observations Escherich lays down the following rules, recognizing two well-defined forms of intestinal fermentation—the acid and the alkaline: If there is much decomposition, with foul, offensive stools, the albuminous articles should be withheld from the diet and the carbohydrates given, such as dextrin foods, sugar, and milk, which, on account of its sugar, ranks with the carbohydrates. If there is acid fermentation, with sour but not fetid stools, an albuminous diet is given, such as broths and egg albumen. It is, however, by no means certain whether the reaction of the stools, upon which this author relies, is a sufficient test of the nature of the intestinal fermentation. In the dyspeptic diarrhœas of artificially fed infants it is best, as a rule, to withhold milk and to feed the child, for the time at least, on egg albumen, broths, and beef juices. To prepare the egg albumen, the whites of two or three eggs may be stirred in a pint of water and a teaspoonful of brandy and a little salt mixed with it. The child will usually take this freely, and it is both stimulating and nourishing. It is sometimes remarkable with what rapidity a child which has been fed on artificial food and milk will pick up and improve on this diet alone. Beef-juice is obtained by pressing with a lemon-squeezer fresh steak, previously minced and either uncooked or slightly broiled. This may be given alternately with the egg albumen or it may be given alone. Mutton or chicken broth will be found equally serviceable, but it is prepared with greater difficulty and contains more fat. In the preparation, a pound of mutton, chicken, or beef, carefully freed from fat, is minced and placed in a pint of cold water and allowed to stand in a glass jar on ice for three or four hours. It should then be cooked over a slow fire for at least three hours, then strained, allowed to cool, the fat skimmed off, sufficient salt added, and it may then be given either warm or cold. These naturally prepared albumen foods are very much to be preferred to the various artificial substances. There is no form of nourishment so readily assimilated and apt to cause so little disturbance as egg albumen or the simple beef juices. The child should be fed every two hours, and in the intervals water may be freely given. It cannot be expected that, with the digestion seriously impaired, as much food can be taken as in health,

and in many instances we see the diarrhœa aggravated by persistent overfeeding. When the child's stomach is quieted and the diarrhœa checked there may be a gradual return to the milk diet. The milk should be sterilized, and in institutions and in cities this simple prophylactic measure is of the very first importance and is readily carried out by means of the Arnold steam sterilizer. The milk should be at first freely diluted—four parts of water to one of milk, which is perhaps the preferable way—or it may be peptonized. The stools should be examined daily, as important indications may be obtained from them. Milk-whey and forms of fermented milk are sometimes useful and may be employed when the stomach is very irritable. These general directions as to food also hold good in cholera infantum.

Medicinal Treatment.—The first indication in the dyspeptic diarrhœa of children is to get rid of the decomposing matter in the stomach and intestines. The diarrhœa and vomiting partially effect this, but it may be more thoroughly accomplished, so far as the stomach is concerned, by irrigation. It may seem a harsh procedure in the case of young infants, but in reality, with a large-sized soft-rubber catheter, it is practised without any difficulty. By means of a funnel, lukewarm water is allowed to pass in and out until it comes away quite clear. I can speak in the very warmest manner of the good results obtained by this simple procedure in cases of the most obstinate gastro-intestinal catarrh in children. In most cases the warm water is sufficient. In some hands this method has probably been carried to excess, but that does not detract from its great value in suitable cases. To remove the fermenting substances from the intestines, doses of calomel or gray powder may be administered. The castor oil is equally efficacious, but is more apt to be vomited. Irrigation of the large bowel is useful, and not only thoroughly removes fermenting substances, but cleanses the mucosa. The child should be placed on the back with the hips elevated. A flexible catheter is passed for from six to eight inches and from a pint to two pints of water allowed to flow in from a fountain syringe. A pint will thoroughly irrigate the colon of a child of six months and a quart that of a child of two years. The water may be lukewarm, but when there is high fever ice-cold water may be used. In cases of entero-colitis there may be injections with borax, a drachm to the pint, or dilute nitrate of silver, which may be either given in large injections, as in the adult, or in injections of three or four ounces with three grains of nitrate of silver to the ounce. These often cause very great pain, and it is well in such cases to follow the silver injection with irrigations of salt solution, a drachm to a pint.

We are still without a reliable intestinal antiseptic. Neither naphthalin, salol, resorcin, the salicylates, nor mercury meets the indications. As in the diarrhœa of adults, bismuth in large doses is often very effective, but practitioners are in the habit of giving it in doses which are quite insufficient. To be of any service it must be used in large doses, so that an

infant a year old will take as much as two drachms in the day. The gray powder has long been a favorite in this condition and may be given in half-grain doses every hour. It is perhaps preferable to calomel, which may be used in small doses of from one tenth to one fourth of a grain every hour at the onset of the trouble. The sodium salicylate (in doses of two or three grains every two hours to a child a year old) has been recommended.

In cholera infantum serious symptoms may develop with great rapidity, and here the incessant vomiting and the frequent purging render the administration of remedies extremely difficult. Irrigation of the stomach and large bowel is of great service, and when the fever is high ice-water injections may be used or a graduated bath. As in the acute choleraic diarrhœa of adults, morphia hypodermically is the remedy which gives greatest relief, and in the conditions of extreme vomiting and purging, with restlessness and collapse symptoms, this drug alone commands the situation. A child of one year may be given from $\frac{1}{100}$ to $\frac{1}{80}$ of a grain, to be repeated in an hour, and again if not better. When the vomiting is allayed, attempts may be made to give gray powder in half-grain doses with $\frac{1}{10}$ of Dover's powder. Starch (℥ ij) and laudanum (♏ij–iij) injections, if retained, are soothing and beneficial. The combination of bismuth with Dover's powder will also be found beneficial. No attempt should be made to give food. Water may be allowed freely, even when ejected at once by vomiting. Small doses of brandy or champagne, frequently repeated and given cold, are sometimes retained. When the collapse is extreme, hypodermic injections of one per cent saline solution may be used as recommended in Asiatic cholera, and hypodermic injections of ether and brandy may be tried. The convalescence requires very careful management, as many cases pass on into the condition of entero-colitis. When the intense symptoms have subsided, the food should be gradually given, beginning with teaspoonful doses of egg albumen or beef-juice. It is best to withhold milk for several days, and when used it should be at first completely peptonized or diluted with gruel. A teaspoonful of raw, scraped meat three or four times a day is often well borne.

II. MISCELLANEOUS AFFECTIONS OF THE BOWELS.

Dilatation of the Colon.—This may be general or localized to the sigmoid flexure.

It occurs not infrequently as a transient condition, and in many cases it has an important influence, inasmuch as the distention may be extreme, pushing up the diaphragm and seriously impairing the action of the heart and lungs. H. Fenwick has called attention to this as occasionally a cause of sudden heart-failure.

Dilatation of the sigmoid flexure occurs particularly when this portion of the bowel is congenitally very long. In such cases the bowel may be so distended that it occupies the greater part of the abdomen, pushing up the liver and the diaphragm. An acute condition is sometimes caused by a twist in the mesocolon.

There is a chronic form in which the gut reaches an enormous size. The coats may be hypertrophied without evidence of any special organic change in the mucosa. In a specimen which I saw with W. E. Hughes, in Philadelphia, the colon was enormously dilated and held fourteen pints of water, and the sigmoid flexure was four inches in diameter. It was removed from a boy, aged three, who had had obstinate constipation and at the age of two an attack of entero-colitis. At one time he was nineteen days without a passage; on another occasion twenty-four. The abdomen was enormously distended, everywhere tympanitic. The hypertrophy of the bowel-wall was much greater toward the sigmoid flexure than near the cæcum. In the section on Constipation in Infants a case is referred to in which the colon and sigmoid flexure appeared to be dilated.

Infarction of the Bowel.—The mesenteric vessels are terminal arteries, and when blocked by emboli or thrombi the condition of infarction follows in the territory supplied. Probably the occlusion of small vessels does not produce any symptoms and the circulation may be re-established. If the superior mesenteric artery is blocked a serious and fatal condition follows. Three instances have come under my observation. In one, a woman aged fifty-five was seized with nausea and vomiting, which persisted for more than a week. There was pain in the abdomen, tympanites, and toward the close the vomiting was incessant and fæcal. The autopsy showed great congestion, with swelling and infiltration of the jejunum and ileum. The superior mesenteric artery was blocked at its orifice by a firm thrombus. In the second case, a woman aged seventy-five was seized with severe abdominal pain and frequent vomiting. At first there was diarrhœa; subsequently the symptoms pointed to obstruction, with great distention of the abdomen. The post-mortem showed the small bowel, with the exception of the first foot of the jejunum and the last six inches of the ileum, greatly distended and deeply infiltrated with blood. The mesentery was also congested and infiltrated. The superior mesenteric artery contained a firm brownish-yellow clot. There were many recent warty vegetations on the mitral valve. In the third case, a man aged forty was suddenly seized with intense pain in the abdomen, became faint, fell to the ground, and vomited. For a week he had persistent vomiting, severe diarrhœa, tympanites, and great pain in the abdomen. The stools were thin and at times blood-tinged. The autopsy showed an aneurism involving the aorta at the diaphragm. The superior mesenteric artery, half an inch from its origin on the sac, was blocked by a portion of the fibrinous clot of the aneurism. In the horse, infarction of the intestine is

Walsem has analyzed the symptoms in 27 cases, in 18 there was pain usually colicky & violent; diarrhea occurred in 14; vomiting in 14; abdominal distension in 12. In a majority of the cases the heart in the abdominal aorta was diseased. In one of the cases the tumor grew enough to have required a successful resection of the bowel.

W Elliot has operated upon two cases of infarction of the bowel in one of which thrombosis of the superior mesenteric vein, he resected successfully 48 inches of the ileum and the patient recovered.

Summation of symptoms & time of intestinal perforation. & of peritonitis

III Intestinal Concretions.

IV Intestinal hæmorrhage.

V Enteralgia

extremely common in connection with the verminous aneurisms of the mesenteric arteries and is the usual cause of colic in this animal.

III. APPENDICITIS.

(Typhlitis and Perityphlitis).

This is one of the most important of intestinal affections. Unfortunately, much confusion still exists about the forms of inflammation in the cæcal region. Thus there are recognized *typhlitis*, inflammation of the cæcum itself; *perityphlitis*, inflammation of the peritonæum covering the cæcum; *paratyphlitis*, inflammation of the connective tissue behind the cæcum, or, more correctly, as the cæcum is usually covered by a serous membrane, of the connective tissue in the neighborhood of this part of the bowel. The use of the last two terms should be altogether discarded, as the cases are, with rare exceptions, due to disease of the appendix vermiformis, and not to affections of the cæcum.

We have in the cæcal region the following affections:

Typhlitis, inflammation of the cæcum proper—a doubtful and uncertain malady, the pathology of which is unknown, but which clinically is still recognized by authorities. A majority of the cases are unquestionably due to appendix disease.

Appendicitis: (1) Catarrhal; (2) ulcerative; (3) perforative, with the production of abscesses, which may be pericæcal, pelvic, intra-peritoneal, perinephritic, or lumbar, depending on the situation of the vermiform process.

TYPHLITIS.

At present inflammation of any sort, accompanied by pain in the right iliac fossa, is generally thought to be due to disease of the appendix; and, so far as post-mortem statistics indicate, an immense majority of all these cases are due to this cause. Clinically, however, authors still recognize typhlitis (inflammation of the cæcum), associated with lodgment of fæces (*typhlitis stercoralis*) The cases are met with in young persons, in boys more commonly than in girls; the subjects have usually been constipated, or there have been errors in diet. The patient complains of pain in the right iliac fossa; there are constipation, nausea, sometimes vomiting; fever, if present, is usually slight, rarely rising above 101°. There is fulness in the right iliac fossa, the decubitus is dorsal, and the right thigh may be flexed. On pressure there is tenderness, and in many instances a doughy, sausage-shaped tumor in the right flank. The attack lasts for from three days to a week, the pain gradually subsides, the tumor mass disappears, and recovery is complete.

The anatomical condition is unknown, and it is by no means certain that these cases are in reality cæcal. Many are probably due to dis-

ease of the appendix, and even when the sausage-shaped, doughy tumor, regarded as diagnostic of typhlitis stercoralis, is present, the cæcitis and fæcal retention may be secondary. The cases do well; a great majority of them terminate favorably, a point which, as Pepper remarks, is opposed to the belief that they are all dependent upon appendix disease.

In the *treatment* of this condition an ice-bag should be placed over the cæcal region, large enemata given once or twice a day to empty the colon, and opium given to allay the pain.

More serious disease of the cæcum does occasionally occur, and there are a few instances in which an ulcer perforates. The rarity of this, however, is shown by the fact that Fitz was only able to collect three cases. Two instances have come under my observation in which perforation of an ulcer in the cæcum led to extensive pericæcal abscess.

APPENDICITIS.

The appendix vermiformis is extremely variable in position. It commonly lies behind the ileum with the tip pointing toward the spleen. It is frequently turned up behind the cæcum or it lies upon the psoas muscle with its tip at the margin of the pelvis. It has, however, been found in almost every region of the abdomen. Thus in my post-mortem notes it is stated to have been found in close contact with the bladder; adherent to the ovary or broad ligament; in the central portion of the abdomen, close to the navel; in contact with the gall-bladder; passing out at right angles and adherent to the sigmoid flexure to the left of the middle line of the abdomen; and in one case it passed with the cæcum into the inguinal canal, curved upon itself, re-entered the abdomen, and was adherent to the wall of an abscess cavity just to the right of the promontory of the sacrum. Foreign bodies rarely lodge in it. Only two instances have come under my notice; in one there were eight snipe shot and in the other five apple pips. On the other hand, oval bodies resembling date stones are very common. They consist of inspissated mucus and fæces, in which in time lime salts are deposited, forming enteroliths.

Post-mortem examinations show that the appendix is very frequently the seat of extensive disease, past or present, without the history of any definite symptoms pointing to trouble in the cæcal region. Among the commonest of these conditions is obliteration, either total or partial. When at the cæcal end, the appendix may be enormously dilated, forming a tumor the size of the thumb or as large as a sausage. In the cases of obliteration the appendix may be free, more commonly it is adherent, and there may be about it signs of old inflammation or even a small encapsulated abscess, which has given no trouble.

Etiology.—Appendicitis is a disease of young persons. According to Fitz's statistics, more than fifty per cent of the cases occur before the twentieth year; sixty per cent between the sixteenth and thirtieth years

Anatomy.
Morbid anatomy
Etiology
Symptoms

~~Appendicitis has~~ At last, appendicitis, as ~~has~~ achieved many years ago, has received the attention which its importance demands, & while in ~~some~~ the hands of ~~surgeons~~ surgeons there has been ~~a~~ fatal intemperance with judgment ~~in the~~ ~~part of surgeons~~ the general results have been good ~~beyond measure and~~ not only in ~~the~~ ~~less~~ suffering but the more prompt recognition of the perforative cases but in the relief of suffering in the more chronic forms. The activity of writers on this subject is evidenced by the appearance of several special monographs. by Kelynack, Thompson, Fowler, Hamilton & Sonnenberg.

as if on a scale of erection.

(Einhorn). It has been met with as early as the seventh week, but it is rarely seen prior to the third year. It is very much more common in males than in females—eighty per cent, according to the tables of Fitz, but in his personal experience in 72 cases males were only twice as frequently affected as females. Contrary to the general experience, the Munich figures (Einhorn) indicate a relatively greater number of women attacked. The fæcal concretions and foreign bodies already referred to probably play the most important *rôle* in the etiology of the disease. In a series of 152 cases the fæcal masses were present in forty-seven per cent and foreign bodies in twelve per cent. Matterstock, in 169 cases of perforative appendicitis, found the percentage to be fifty-three and twelve, respectively. Typhoid fever and tuberculosis frequently induce ulceration of the appendix, but not often perforation. Fitz suggests that some of the cases of peritonitis which recover in typhoid fever are due to perforation of the appendix. Traumatism plays a very definite *rôle*, and in a number of cases the symptoms have followed the lifting of a heavy weight, or a fall or a blow. Constipation, overloading the stomach with indigestible food, indiscretions in diet, are mentioned in many cases. The tendency of the disease to recur is remarkable. Among 257 cases (Fitz) eleven per cent had had previous attacks. In the recurring appendicitis no factor is of greater importance than overeating, and attacks may follow directly upon the taking of large quantities of unsuitable food.

Morbid Anatomy.—For practical purposes we recognize a catarrhal and an ulcerative appendicitis. In *catarrhal appendicitis* the entire tube is thickened, the peritoneal surface may be slightly injected, and adhesions may have formed, so that there is a slight circumscribed peritonitis. The lumen may be much contracted, particularly toward the cæcal end; the mucosa is thickened, covered with a tenacious mucus; and very commonly fæcal concretions or small enteroliths are present. The coats are thickened throughout, particularly the muscularis, and the entire tube is firm and stiff. It may attain the size of the index finger or even that of the thumb. When laid open longitudinally, it at once assumes a rolled form in the reverse direction.

Ulceration and Perforation of Appendix.—Many cases of ulcer present no symptoms. In typhoid fever and phthisis eleven instances have come under my observation in which there were no clinical indications of the lesion. The dangerous ulcers follow the irritation of the fæcal concretions or foreign bodies. It may result also from obliteration of the cæcal end and distention of the lumen with fluid. The perforation may have the following direct effects: (*a*) The appendix may hang free in the peritoneal cavity, adhesions not having formed, when the perforation at once excites a diffuse and violent suppurative peritonitis.

(*b*) More commonly, in fact, almost as a rule, the ulcerated appendix becomes adherent and a localized peritonitis results. Perforation then occurs, with the formation of a circumscribed intraperitoneal abscess

cavity, which may be small and which varies in situation with the appendix. Perhaps the most common situation is on the psoas muscle, in the neighborhood of the terminal portion of the ileum. In cases of this sort I have most frequently found the small localized abscess just at the angle between the ileum and the cæcum. It may, however, be within the pelvis or close to the sacrum. Adhesive peritonitis, perforation, and the formation of a localized abscess may go on without the production of serious symptoms, and the condition may be found when death has resulted from accident or some intercurrent affection. In some cases a large circumscribed fæcal abscess forms in the iliac region and points midway between the navel and the anterior superior spine of the ilium.

Unfortunately, in many cases the localized abscess cavity excites the most intense peritonitis. Often without actual rupture diffuse suppurative disease occurs. In many instances the first indication of serious trouble is the acute, agonizing pain which follows the diffusion of this localized peritoneal process. The contents of the limited abscess may not be more than a few cubic centimetres, are usually darkish gray in color, and excessively offensive.

(*c*) When the appendix passes behind the cæcum and colon and is not within the peritonæum, perforation at once produces a retroperitoneal abscess, which may terminate in many different ways; thus the pus may pass beneath the iliacus fascia and appear at Poupart's ligament, in which situation external perforation may occur and recovery take place. The pus may be chiefly in the retroperitoneal tissue in the flank, forming a large perinephritic abscess. In a case under the care of Gardner, of Montreal, an enormous abscess cavity developed in this situation, which contained air, pushed up the diaphragm nearly to the second rib, and produced the symptoms of pneumothorax. Perforation of the pleura may occur in these cases, forming a fæcal pleural fistula. The pus may extend along the psoas muscle and may perforate the hip joint, or pass to the neighborhood of the rectum, or produce multiple abscesses of the scrotum, or, passing through the obturator foramen, form a large gluteal abscess. Perforation into the bladder may occur, but is not nearly so common as perforation into the bowel. In both instances recovery may follow, though there is greater danger in perforation into the latter. The appendix has been discharged *per anum*.

The remote effects of perforative appendicitis are interesting. Hæmorrhage may occur. In one of my cases the appendix was adherent to the promontory of the sacrum, and the abscess cavity had perforated in two places into the ileum. Death resulted from profuse hæmorrhage. Cases are on record in which the internal iliac artery or the deep circumflex iliac artery has been opened. Suppurative pylephlebitis may result from inflammation of the mesenteric veins near the perforated appendix. Two instances of it have come under my notice; in one there was a small localized abscess which had resulted from the perforation of a typhoid ulcer

The perforated appendix

Why stercoral? (D)

In both the intra & extraperitoneal appendicitis cases

may

of the appendix. In the other case, which I saw with Matchell, of Toronto, the symptoms were those of septicæmia and suppuration of the liver. The abscess of the appendix was small and had not produced symptoms. In the healing of extensive inflammation about the margin of the pelvis the iliac veins may be greatly compressed, and one of my patients had for months œdema of the right leg, which is still enlarged.

Symptoms.—As already mentioned, a simple catarrhal appendicitis may lead to a fatal result, and, on the other hand, perforation and abscess formation may take place without exciting serious symptoms. No classification into light, medium, and severe forms can be made, as the most severe of all features of the disease—general peritonitis—may be the very first indication of the existence of any trouble.

Catarrhal inflammation may induce the most characteristic features of appendix disease. The facts on which this statement is made are conclusive. A man aged twenty-eight was admitted to the Johns Hopkins Hospital with pains in the abdomen, localized in the right iliac fossa, which in July became severe enough to confine him to bed for several weeks. In August the attack returned with severity. No tumor was to be felt externally, but on rectal examination a firm, rounded body could be felt high up on the right margin of the pelvis. Laparotomy was performed and the appendix found in the true pelvis, slightly adherent, very much thickened, but without perforation or ulceration. Bridge reports an instance in which a woman aged twenty-eight had an attack of severe abdominal pain, vomiting, constipation, but no tumor. The temperature rose as high as 101°, the thighs were flexed, and there was pain on extension of the psoas. Temporary improvement followed and then a recurrence, accompanied with rise of temperature and return of the pain. Laparotomy was performed and a thickened, dense appendix found, which contained three small enteroliths. In both these instances persistent, severe symptoms were caused by what must be termed a chronic inflammation of the appendix, without ulceration and without perforation. Both cases recovered. A similar instance has occurred at the Pennsylvania Hospital, under the care of Thomas G. Morton. A suppurative peritonitis may also occur without perforation or ulceration. In a case reported by Fitz there had been previous attacks, from which recovery by resolution had taken place; then an abscess at the brim of the pelvis was opened and drained. After recovery again a recurrence occurred, and finally the appendix was removed and found to be thickened, but neither ulcerated nor perforated, and only adherent in a limited extent to the omentum.

In *perforative appendicitis* there may be initial symptoms, such as nausea, constipation, sometimes diarrhœa, and a sense of uneasiness and distress in the right iliac fossa. These may possibly be associated with the localized peritonitis. A sudden violent pain in the abdomen, most commonly in the right iliac fossa, is the "most constant, first decided symp-

tom of perforating inflammation of the appendix," and occurred in eighty-four per cent of the cases analyzed by Fitz. It is usually limited to the fossa, but sometimes extends toward the navel or to the perinæum, testicle, or thigh. Fever, furred tongue, and vomiting may precede or accompany this pain. An initial chill is rare. The temperature ranges from 101° to 103°; sometimes it is higher; the pulse is increased in frequency. The patient in walking bends over, favors the right side, and has difficulty in standing straight. When in bed the patient usually lies with the right leg drawn up and complains of pain on extension. Micturition may be frequent or there may be retention of urine. Diarrhœa seems to be more frequent in children than in adults.

Physical Signs.—Tympanites may be early and interfere considerably with the examination. On the other hand, the abdomen may be flat, hard, and board-like even with diffuse peritonitis. In a great majority of the cases there is tenderness in the right iliac fossa and over the region of the appendix. McBurney has called attention to the value of a special localized point of tenderness on deep pressure situated from one and a half to two inches from the anterior superior spine of the ileum on a line drawn between this point and the navel. When firm, continuous pressure is made with one finger at this point the pain may be of the most exquisite character. Circumscribed swelling may be present, but it is inconstant and is not found in more than one half the cases. It is usually in the fossa below a line passing from the anterior superior spine to the navel and two or three finger-breadths above Poupart's ligament. In many instances it is a diffuse thickening and induration; in others a well-defined tumor mass can be detected. If there is much tension of the abdominal muscles and pain, it is best to make a thorough examination under ether. In the cases in which the abscess is large, fluctuation may be felt above Poupart's ligament or in the flank, and in some instances crepitation. Dulness is not present unless the exudation is abundant and superficial. Usually the small localized tumors are entirely masked by the distended intestines. A rectal examination should be made in every instance. When the appendix is above the brim of the pelvis it cannot be reached, but when, as so often happens, it curls over into the pelvis, it or the thickened indurated area about it may be felt. After all, the great danger is not so much in the limited peritonitis which results from the perforation, as in the extension of it to the general peritonæum. In Fitz's analysis, the second, third, and fourth days included the largest number of cases of beginning peritonitis. General abdominal pain, tympanites and an aggravation of the general symptoms indicate the onset of this serious complication.

Diagnosis.—Appendicitis is by far the most common inflammatory condition producing symptoms, not only in the cæcal region but in the abdomen, generally in persons under thirty. Laparotomy has taught us that, almost without exception, sudden pain in the right iliac fossa with

We are ~~so often~~ ready now-a-days to make the diagnosis of Appendicitis ~~that in cases of severe pain in the abd with fever & an irregular~~
Acute Cholecystitis
I know that the mistakes are both interesting and instructive
In a woman with acute suppurative cholecystitis & high fever
admitted ~~not~~ many years ago the surgeons operated the
diagnosis. And I was told of a case recently in one of the
large Hospitals of the country in which the fever & the presence of
a tender induration in the right iliac fossa led the diagnosis
of appendicitis: the tenderness induration was found to be
the swollen gall & adjacent glands of Typhoid fever

Lastly there is a well marked appendicular hypochondriasis
I believe I have ~~noted~~ advised ~~many persons against~~ Though the sermons influence of the daily press
~~Spread~~ has become the appendicitis has become a 'fad' and
it has become an important duty of the Physician to claim
between the patient and the Surgeon. Plagiarism as long ago
a well known Scotch or Swedish city had one might an-
nouncing attack of 'belly ache' - the surgeon was called summoned
& the appendix was removed. I know of two instances of hyperplasia
were removed. Nothing that any strong opinion of the writer.

fever, localized tenderness with or without tumor, means appendix disease. Almost the only other local condition to be differentiated is stercoral cæcitis, which is characterized by less severe pain, slighter fever, and the presence of an elongated doughy mass in the lumbar region; it must be remembered that in many of these cases the appendix is probably affected.

Perinephritic and pericæcal abscess from perforation of ulcer, either simple or cancerous, and circumscribed peritonitis in this region from other causes can rarely be differentiated until an exploratory incision is made.

Catarrhal and perforative appendicitis cannot always be differentiated, as the cases which I have quoted show that in intensity of pain, severity of symptoms, and even in the production of peritonitis, the two may be identical.

Briefly stated, localized pain in the right iliac fossa with or without induration or tumor, the existence of McBurney's tender point, fever, furred tongue, vomiting, constipation or diarrhœa, indicate appendicitis. The occurrence of general peritonitis is suggested by increase and diffusion of the abdominal pain, tympanites (as a rule), marked aggravation of the constitutional symptoms, particularly elevation of fever and increased rapidity of the pulse. Alonzo Clark's sign, obliteration of hepatic dulness, is rarely present, as the peritonæum in these cases does not often contain gas.

The hypodermic needle should never be used unless there is marked tumor with dulness on percussion in the cæcal region.

Intussusception and internal strangulation may present very similar symptoms, and if the patient is only seen at the latter stages, when there is diffuse peritonitis and great tympany, the features may be almost identical. Fæcal vomiting, which is common in obstruction, is never seen in appendicitis, and in children the marked tenesmus and bloody stools are important signs of intussusception. It is not often difficult when the cases are seen early and when the history is clear, but mistakes have been made by surgeons of the first rank.

In women, disease of the tubes and pelvic peritonitis from any cause may simulate appendicitis; but the history and the local examination, under ether, should in most cases enable the practitioner to discriminate between these conditions. In neurotic patients the odd and anomalous symptoms produced by floating kidney may be thought to be due to appendicitis.

Prognosis.—If we regard every case of inflammation in the cæcal region as appendicitis, a large proportion of the cases recover. The gravity of the disease is difficult to estimate, but it certainly must be ranked as one of the most serious and fatal of the abdominal affections of young persons. Post-mortem observations show that very many instances get well, often without treatment. As mentioned, recurrence is common, so much so that over forty per cent of the cases may be spoken of as recurrent ap-

pendicitis. Sixty-eight per cent of the fatal cases die during the first eight days. Extension to the general peritonæum is almost always fatal. Perforation into the bowel is often followed by recovery. Perforation externally is still less serious. Nowadays, with the prompt surgical interference, the prognosis is very much better.

Treatment.—The studies of Pepper, Noyes, With, and Matterstock, and more particularly the elaborate and thorough study of Fitz, have directed the attention of physicians to the clinical features of the diseases in the cæcal region, but to the surgeons we owe invaluable lessons relating to diagnosis and, above all, to treatment.

The suggestion of Willard Parker with reference to early operation has been carried out and advocated by Sands, Bull, and Weir in New York, by Morton and Keen in Philadelphia, and by Treves in London.

Treatment of the Attack.—The medical treatment of appendicitis can be expressed in three words—rest, opium, and enemata. The patient should be quiet in bed with an ice-bag placed in the right iliac fossa. If there is much pain, opium should be given either hypodermically or by the mouth. Medium-sized injections of warm water may be given twice daily. I would protest most earnestly against the indiscriminate use of saline purges, which have been advocated under a total misapprehension. It cannot be too strongly emphasized that, as a rule, the initial condition, which produces the pain, the fever, and the local signs, is the establishment after perforation of a localized peritonitis. So long as the abscess cavity remains limited, resolution is possible. Saline purges mean more or less disturbance of the local conditions and a definite increase in the risk of general peritonitis. It is an entirely different matter when this is established. Salines in some instances then do good, but in appendicitis, when the general peritonæum is involved, the mischief is done, and neither salines nor laparotomy materially influence the result.

The profession has yet to learn the lesson that perforative appendicitis is in more than three fourths of all cases a surgical affection, and perhaps the most important function of the physician, under whose care the disease always comes at first, is to say whether the case is suitable and when the operation should be performed.

Operation is indicated: (*a*) in all cases of acute inflammatory trouble in the cæcal region when, whether tumor is present or not, the general symptoms are severe, as shown by tympany, spreading pain, increase in fever, and increase in the rapidity of the pulse. In so many of the cases no tumor is to be felt that stress cannot be laid upon its absence.

(*b*) When a definite tumor is present, associated with attacks such as have been described, particularly if they have been recurrent. An occasional exception may be made to this rule when, even with small tumor, the symptoms rapidly subside and the patient improves. We are here on the horns of a dilemma. On the one hand, it is in just such cases that perforation and fatal peritonitis may at any moment occur, and, on the

other, the tumor may gradually disappear and the patient may have no further trouble.

(*c*) In recurrent appendicitis, when the attacks are of such severity and frequency as seriously to interrupt the patient's occupation. Is the interim operation advisable or shall the patient be advised to wait until an attack? Opinions differ on this point. It is best, I think, to wait. The operation has risks; patients have died from the interim laparotomy; and there is always a chance that the recovery from an attack may prove permanent. Both clinical observation and morbid anatomy show that complete healing is by no means rare. The physician must be guided too by the character of the surgical technique at his command, and could hand over his patient without qualms to a modern operator whose success has demonstrated the safety of his methods.

IV. INTESTINAL OBSTRUCTION.

Intestinal obstruction may be caused by strangulation, intussusception, twists and knots, strictures and tumors, and by abnormal contents.

Etiology and Pathology.—(*a*) **Strangulation.**—This is the most frequent cause of acute obstruction, and occurred in thirty-four per cent of the 295 cases analyzed by Fitz,* and in thirty-five per cent of the 1,134 cases of Leichtenstern.† Of the 101 cases of strangulation in Fitz's table, which has the special value of having been carefully selected from the literature since 1880, the following were the causes: Adhesions, 63; vitelline remains, 21; adherent appendix, 6; mesenteric and omental slits, 6; peritoneal pouches and openings, 3; adherent tube, 1; peduncular tumor, 1. The bands and adhesions result, in a majority of cases, from former peritonitis. A number of instances have been reported following operations upon the pelvic organs in women. The strangulation may be recent and due to adhesion of the bowel to the abdominal wound or a coil may be caught between the pedicle of a tumor and the pelvic wall. Such cases are only too common. Late occlusion after recovery from the operation is due to bands and adhesions.

The vitelline remains are represented by Meckel's diverticulum, which forms a finger-like projection from the ileum, usually within eighteen inches of the ileo-cæcal valve. It is a remnant of the omphalo-mesenteric duct, through which, in the early embryo, the intestine communicated with the yolk-sac. The end, though commonly free, may be attached to the abdominal wall near the navel, or to the mesentery, and a ring is thus formed through which the gut may pass.

Seventy per cent of the cases of obstruction from strangulation occur

* Transactions of the Congress of American Physicians and Surgeons, vol. i, 1889. The percentages of his tables are used throughout this section.

† Von Ziemssen's Encyclopædia of Practical Medicine.

in males; forty per cent of all the cases occur between the ages of fifteen and thirty years. In ninety per cent of the cases of obstruction from these causes the site of the trouble is in the small bowel; the position of the strangulated portion was in the right iliac fossa in sixty-seven per cent of the cases, and in the lower abdomen in eighty-three per cent.

(*b*) **Intussusception.**—In this condition one portion of the intestine slips into an adjacent portion, forming an invagination or intussusception. The two portions make a cylindrical tumor, which varies in length from a half-inch to a foot or more. The condition is always a descending intussusception, and as the process proceeds, the middle and inner layers increase at the expense of the outer layer. An intussusception consists of three layers of bowel: the outermost, known as the intussuscipiens, or receiving layer; a middle or returning layer; and the innermost or entering layer. The student can obtain a clear idea of the arrangement by making the end of a glove-finger pass into the lower portion. The actual condition can be very clearly studied in the post-mortem invaginations which are so common in the small bowel of children. In the statistics of Fitz, 93 of 295 cases of acute intestinal obstruction were due to this cause. Of these, 52 were in males and 27 in females. The cases are most common in early life, thirty-four per cent under one year and fifty-six per cent under the tenth year. No definite causes could be assigned in 42 of the cases; in the others diarrhœa or habitual constipation had existed.

The site of the invagination varies. We may recognize (1) an *ileo-cæcal*, when the ileo-cæcal valve descends into the colon. There are cases in which this is so extensive that the valve has been felt per rectum. This form occurred in seventy-five per cent of the cases. In the *ileo-colic* the lower part of the ileum passes through the ileo-cæcal valve. (2) The *ileal*, in which the ileum is alone involved. (3) The *colic*, in which it is confined to the large intestine. And (4) *colico-rectal*, in which the colon and rectum are involved.

Irregular peristalsis is the essential cause of intussusception. Nothnagel found in the localized peristalsis caused by the faradic current that it was not the descent of one portion into the other, but the drawing up of the receiving layer by contraction of the longitudinal coat. Invagination may follow any limited, sudden, and severe peristalsis.

In the post-mortem examination, in a case of death from intussusception, the condition is very characteristic. Peritonitis may be present or an acute injection of the serous membrane. When death occurs early, as it may do from shock, there is little to be seen. The portion of bowel affected is large and thick, and forms an elongated tumor with a curved outline. The parts are swollen and congested, owing to the constriction of the mesentery between the layers. The entire mass may be of a deep livid-red color. If very recent there is only congestion, and perhaps a slight layer of lymph, and the intussusception can be reduced, but when it

has lasted for a few days, lymph is thrown out, the layers are glued together, and the entering portion of the gut cannot be withdrawn.

The anatomical condition accounts for the presence of the tumor, which exists in two thirds of all cases; and the engorgement, which results from the compression of the mesenteric vessels, explains the frequent occurrence of blood in the discharges, which has so important a diagnostic value. If the patient survives, necrosis and sloughing of the invaginated portion may occur, and if union has taken place between the middle and outer layer, the calibre of the gut may be restored and a cure in this way effected. Many cases of the kind are on record. In the Museum of the Medical Faculty of McGill University are 17 inches of small intestine, which were passed by a lad who had had symptoms of internal strangulation, and who made a complete recovery.

(*c*) **Twists and Knots.**—Volvulus or twist occurred in 42 of the 295 cases. Sixty-eight per cent were in males. It is most frequent between the ages of thirty and forty. In the great majority of all cases the twist is axial and associated with an unusually long mesentery. In fifty per cent of the cases it was in the sigmoid flexure. The next most common situation is about the cæcum, which may be twisted upon its axis or bent upon itself. As a rule, in volvulus the loop of bowel is simply twisted upon its long axis, and the portions at the end of the loop cross each other and so cause the strangulation. It occasionally happens that one portion of the bowel is twisted about another.

(*d*) **Strictures and Tumors.**—These are very much less important causes of acute obstruction, as may be judged by the fact that there are only 15 instances out of the 295 cases, in 14 of which the obstruction occurred in the large intestine. On the other hand, they are common causes of chronic obstruction.

The obstruction may result from: (1) *Congenital stricture.* These are exceedingly rare. Much more commonly the condition is that of complete occlusion, either forming the imperforate anus or the congenital defect by which the duodenum is not united to the pylorus. (2) *Simple cicatricial stenosis*, which results from ulceration, tuberculous or syphilitic, more rarely from dysentery, and most rarely of all from typhoid ulceration. (3) *New growths.* The malignant strictures are due chiefly to cylindrical epithelioma, which forms an annular tumor, most commonly met with in the large bowel, about the sigmoid flexure, or the descending colon. Of benign growths, papillomata, adenomata, lipomata, and fibromata occasionally induce obstruction. (4) *Compression and traction.* Tumors of neighboring organs, particularly of the pelvic viscera, may cause obstruction by adhesion and traction; more rarely, a coil, such as the sigmoid flexure, filled with fæces, compresses and obstructs a neighboring coil. In the healing of tuberculous peritonitis the contraction of the thick exudate may cause compression and narrowing of the coils.

(*e*) **Abnormal Contents.**—Foreign bodies, such as fruit stones, coins, pins, needles, or false teeth, are occasionally swallowed accidentally, or by lunatics on purpose. Round worms may become rolled into a tangled mass and cause obstruction. In reality, however, the majority of foreign bodies, such as coins, buttons, and pins, swallowed by children, cause no inconvenience whatever, but in a day or two are found in the stools. Occasionally such a foreign body as a pin will pass through the œsophagus and will be found lodged in some adjacent organ, as in the heart (Peabody), or a barley ear may reach the liver (Dock).

Medicines, such as magnesia or bismuth, have been known to accumulate in the bowels and produce obstruction, but in the great majority of the cases the condition is caused by fæces, gall-stones, or enteroliths. Of 44 cases, in 23 the obstruction was by gall-stones, in 19 by fæces, and in 2 by enteroliths. Obstruction by fæces may happen at any period of life. As mentioned when speaking of dilatation of the colon, it may occur in young children and persist for weeks. In fæcal accumulation the large bowel may reach an enormous size and the contents become very hard. The retained masses may be channeled, and small quantities of fæcal matter are passed until a mass too large enters the lumen and causes obstruction. There may be very few symptoms, as the condition may be borne for weeks or even for months.

Obstruction by gall-stones is not very infrequent, as may be gathered from the fact that twenty-three cases were reported in the literature in eight years. Eighteen of these were in women and five in men. In six sevenths of the cases it occurred after the fiftieth year. The obstruction is usually in the ileo-cæcal region, but it may be in the duodenum. These large solitary gall-stones ulcerate through the gall-bladder, usually into the small intestine, occasionally into the colon. In the latter case they rarely cause obstruction. Courvoisier has collected one hundred and thirty-one cases in the literature.

Enteroliths may be formed of masses of hair, more commonly of the phosphates of lime and magnesia, with a nucleus formed of a foreign body or of hardened fæces. Nearly every museum possesses specimens of this kind. They are not so common in men as in ruminants, and, as indicated in Fitz's statistics, are very rare causes of obstruction.

Symptoms.—(*a*) **Acute Obstruction.**—Constipation, pain in the abdomen, and vomiting are the three important symptoms. Pain sets in early and may come on abruptly while the patient is walking or, more commonly, during the performance of some action. It is at first colicky in character, but subsequently it becomes continuous and very intense. Vomiting follows quickly and is a constant and most distressing symptom. At first the contents of the stomach are voided, and then greenish, bile-stained material, and soon, in cases of acute and permanent obstruction, the material vomited is a brownish-black liquid, with a distinctly fæcal odor. This sequence of gastric, bilious, and, finally, stercoraceous vomit-

ing is perhaps the most important diagnostic feature of acute obstruction. The constipation may be absolute, without the discharge of either fæces or gas. Very often the contents of the bowel below the stricture are discharged. Distention of the abdomen usually occurs, and when the large bowel is involved it is extreme. On the other hand, if the obstruction is high up in the small intestine, there may be very slight tympany. At first the abdomen is not painful, but subsequently it may become acutely tender.

The constitutional symptoms from the outset are severe. The face is pallid and anxious, and finally collapse symptoms supervene. The eyes become sunken, the features pinched, and the skin is covered with a cold, clammy sweat. The pulse becomes rapid and feeble. There may be no fever; the axillary temperature is often subnormal. The tongue is dry and parched and the thirst is incessant. The urine is high-colored, scanty, and there may be suppression, particularly when the obstruction is high up in the bowel. This is probably due to the constant vomiting and the small amount of liquid which is absorbed. The case terminates as a rule in from three to six days. In some instances the patient dies from shock or sinks into coma.

(*b*) **Symptoms of Chronic Obstruction.**—When due to fæcal impaction, there is a history of long-standing constipation. There may have been discharge of mucus, or in some instances the fæcal masses have been channeled, and so have allowed the contents of the upper portion of the bowel to pass through. In elderly persons this is not infrequent; but examination, either *per rectum* or externally, in the course of the colon, will reveal the presence of hard scybalous masses. There may be retention of fæces for weeks without exciting serious symptoms. In other instances there are vomiting, pain in the abdomen, gradual distention, and finally the ejecta become fæcal. The hardened masses may excite an intense colitis or even peritonitis.

In stricture, whether cicatricial or cancerous, the symptoms of obstruction are very diverse. Constipation gradually comes on, is extremely variable, and it may be months or even years before there is complete obstruction. There are transient attacks, in which from some cause the fæces accumulate above the stricture, the intestine becomes greatly distended, and in the swollen abdomen the coils can be seen in active peristalsis. In such attacks there may be vomiting, but it is very rarely of a fæcal character. In the majority of these cases the general health is seriously impaired; the patient gradually becomes anæmic and emaciated, and finally, in an attack in which the obstruction is complete, death occurs with all the features of acute occlusion or the case may be prolonged for ten or twelve days.

Diagnosis.—(*a*) **The Situation of the Obstruction.**—Hernia must be excluded, which is by no means always easy, as fatal obstruction may occur from the involvement of a very limited portion of the gut in the

external ring or in the obturator foramen. Mistakes from both of these causes have come under my observation; they were cases in which it was impossible to make a diagnosis other than acute obstruction. Timely operation would have saved both lives. A thorough rectal and vaginal examination should be made, which will give important information as to the condition of the pelvic and rectal contents, particularly in cases of intussusception, in which the descending bowel can sometimes be felt. In cases of obstruction high up the empty coils sink into the pelvis and can there be detected. Rectal exploration with the entire hand is of doubtful value. In the inspection of the abdomen there are important indications, as the special prominence in certain regions, the occurrence of definite, well-defined masses, and the presence of hypertrophied coils in active peristalsis. In obstruction in the duodenum or jejunum there may only be slight distention in the upper part of the abdomen, associated usually with rapid collapse and anuria.

In the ileum and cæcum the distention is more in the central portion of the abdomen; the vomiting is distinctly fæcal and occurs early. In obstruction of the colon, tympanites is much more extensive and general. Tenesmus is more common, with the passage of mucus and blood. The course is not so quick, the collapse does not supervene so rapidly, and the urinary secretion is not so much reduced.

In obstruction from stricture or tumor the situation can in some cases be accurately localized, but in others it is very difficult. Digital examination of the rectum should first be made. The rectal tube may then be passed, but it is impossible to get beyond the sigmoid flexure. In the use of the rigid tube there is danger of perforation of the bowel in the neighborhood of a stricture. The quantity of fluid which can be passed into the large intestine should be estimated. The capacity of the large bowel is about six quarts. The safe limits of pressure have been determined to be under ten feet in an infant and twenty feet in an adult. To thoroughly irrigate the bowel the patient should be chloroformed and should lie on the back or on the side; best on the back with the hips elevated. Treves suggests that the cæcal region should be auscultated during the passage of the fluid. For diagnostic purposes the rectum may be inflated, either by the bellows or by the use of bicarbonate of soda and tartaric acid. In certain cases these measures give important indications as to the situation of the obstruction in the large bowel.

(*b*) **Nature of the Obstruction.**—This is often difficult, not infrequently impossible, to determine. *Strangulation* is not common in very early life. In many instances there have been previous attacks of abdominal pain, or there are etiological factors which give a clew, such as old peritonitis or operation on the pelvic viscera. Neither the onset nor the character of the pain gives us any information. In rare instances nausea and vomiting may be absent. The vomiting usually becomes fæcal from the third to the fifth day. A tumor is not common in strangulation, and

was present in only one fifth of the cases. Fever is not of diagnostic value.

Intussusception is an affection of childhood, and is of all forms of internal obstruction the one most readily diagnosed. The presence of tumor, bloody stools, and tenesmus are the important factors. The tumor is usually sausage-shaped and felt in the region of the transverse colon. It existed in 66 of 93 cases. It was present on the first day in more than one third of the cases, on the second day in more than one fourth, and on the third day in more than one fifth. Blood in the stools occurs in at least three fifths of the cases, either spontaneously or following the use of an enema. The blood may be mixed with mucus. Tenesmus is present in one third of the cases. Fæcal vomiting is not very common and was present in only 12 of the 93 instances. Abdominal tympany is a symptom of slight importance, occurring in only one third of the cases.

Volvulus can rarely be diagnosed. The frequency with which it involves the sigmoid flexure is to be borne in mind. The passage of a flexible tube or injecting fluids might in these cases give valuable indications. An absolute diagnosis can probably be made only by an abdominal section.

In fæcal obstruction the condition is usually clear, as the fæces can be felt per rectum and also in the distended colon. Fæcal vomiting, tympany, abdominal pain, nausea, and vomiting are late and are not so constant. In obstruction by gall-stone a few of the cases gave a previous history of gall-stone colic. Jaundice was present in only two of the twenty-three cases. Pain and vomiting, as a rule, occur early and are severe, and fæcal vomiting is present in two thirds of the cases. A tumor is rarely evident.

(*c*) **Diagnosis from other Conditions.**—Acute enteritis with great relaxation of the intestinal coils, vomiting, and pain may be mistaken for obstruction. In an autopsy on a case of this kind the small and large bowels were intensely inflamed, relaxed, sodden, and enormously distended. The symptoms were those of acute obstruction, but the intestine was free from duodenum to rectum. Of late years many instances have been reported in which peritonitis following disease of the appendix has been mistaken for acute obstruction. The intense vomiting, the general tympany and abdominal tenderness, and in some instances the suddenness of the onset are very deceptive, and in two cases which have come under my notice the symptoms pointed very strongly to internal strangulation. In appendix disease the temperature is more frequently elevated, the vomiting is never fæcal, and in many cases there is a history of previous attacks in the cæcal region. Acute hæmorrhagic pancreatitis may produce symptoms which simulate closely intestinal obstruction. A boy was admitted to the Johns Hopkins Hospital with a history of obstinate vomiting, intense abdominal pain, gradually increasing tympany, and no passage for several days. His condition seemed serious and he was transferred at once to the surgical wards. At the operation the coils were found uniformly

distended and covered in places with the thinnest film of lymph. No obstruction existed, but there was a tumor-like mass surrounding the pancreas, firm, hard, and deeply infiltrated with blood. The patient improved after the operation and recovered completely.

Treatment.—Purgatives should not be given. For the pain hypodermics of morphia are indicated. To allay the distressing vomiting, the stomach should be washed out. Not only is this directly beneficial, but Küssmaul claims that the abdominal distention is relieved, the pressure in the bowel above the seat of obstruction is lessened, and the violent peristalsis is diminished. It may be practised three or four times a day, and in some instances has proved beneficial; in others curative. Thorough irrigation of the large bowel with injections should be practised, the fluid being allowed to flow in from a siphon syringe, and the amount carefully estimated. Jonathan Hutchinson recommends that the patient be placed under an anæsthetic, the abdomen thoroughly kneaded, and a copious enema given while in the inverted position. Then, with the aid of three or four strong men, the patient is to be thoroughly shaken, first with the abdomen held downward, and subsequently in the inverted position.

Inflation may also be tried, by forcing the air into the rectum with the bellows or with a Davidson's syringe. It is a measure not without risk, as instances of rupture of the bowel have been reported. Fitz's figures show that in the first eight years of the last decade there were thirty-three cases of recovery after injection or inflation in cases of certain or probable intussusception, and eleven deaths. In cases of acute obstruction, if these means do not prove successful by the third day, surgical measures should be resorted to, and when the obstruction seems persistent and the condition serious, laparotomy should be performed at once.

For the tympanites turpentine stupes and hot applications may be applied; if extreme, the bowel may be punctured with a small aspirator needle. In cases of chronic obstruction the diet must be carefully regulated, and opium and belladonna are useful for the paroxysmal pains. Enemata should be employed, and if the obstruction becomes complete, resort must be had to surgical measures.

V. CONSTIPATION (*Costiveness*).

Definition.—Retention of fæces from any cause.

Constipation in Adults.—The causes are varied and may be classed as general and local.

General Causes.—(*a*) Constitutional peculiarities: Torpidity of the bowels is often a family complaint and is found more often in dark than in fair persons. (*b*) Sedentary habits, particularly in persons who eat too much and neglect the calls of nature. (*c*) Certain diseases, such as anæmia, neurasthenia and hysteria, chronic affections of the liver, stomach,

Congenital (anatomical) constipation in infants may be due to unusual length of the colon and folding of the sigmoid flexure.

and intestines, and the acute fevers. Under this heading may appropriately be placed that most injurious of all habits, *drug-taking*. (*d*) Either a coarse diet, which leaves too much residue, or a diet which leaves too little may be a cause of costiveness.

Local Causes.—Weakness of the abdominal muscles in obesity or from overdistention in repeated pregnancies. Atony of the large bowel from chronic disease of the mucosa; the presence of tumors, physiological or pathological, pressing upon the bowel; enteritis; foreign bodies, large masses of scybala, and strictures of all kinds. By far the most important local cause is atony of the colon, particularly of the muscles of the sigmoid flexure by which the fæces are propelled into the rectum.

Symptoms.—The most persistent constipation for weeks or even months may exist with fair health. All kinds of evils have been attributed to poisoning by the resorption of noxious matters from the retained fæces—copræmia—but it is not likely that this takes place to any extent. Chlorosis, which Sir Andrew Clark attributes to fæcal poisoning, is not always associated with constipation, and if due to this cause should be in men, women, and children the most common of all disorders. Debility, lassitude, and mental depression are frequent symptoms in constipation, particularly in persons of a nervous temperament. Headache, loss of appetite, and a furred tongue may also occur. Individuals differ extraordinarily in this matter; one feels wretched all day without the accustomed evacuation; another is comfortable all the week except on the day on which by purge or enema the bowels are relieved.

When persistent, the accumulation of fæces leads to unpleasant, sometimes serious symptoms, such as piles, ulceration of the colon, distention of the sacculi, perforation, enteritis, and occlusion. In women pressure may cause pain at the time of menstruation and a sensation of fulness and distention in the pelvic organs. Neuralgia of the sacral nerves may be caused by an overloaded sigmoid flexure. The fæces collect chiefly in the colon. Even in extreme grades of constipation it is rare to find dry fæces in the cæcum. The fæces may form large tumors at the hepatic or splenic flexures, or a sausage-like, doughy mass above the navel, or an irregular lumpy tumor in the left inguinal region. In old persons the sacculi of the colon become distended and the scybala may remain in them and undergo calcification, forming enteroliths.

In cases with prolonged retention the fæcal masses become channelled and diarrhœa may occur for days before the true condition is discovered by rectal or external examination. In women who have been habitually constipated, attacks of diarrhœa with nausea and vomiting should excite suspicion and lead to a thorough examination of the large bowel. Fever may occur in these cases, and Meigs has reported an instance in which the condition simulated typhoid fever.

Constipation in infants is a common and troublesome disorder. The causes are congenital, dietetic, and local. There are instances in which

the child is constipated from birth and may not have a natural movement for years and yet thrive and develop. An instance of the kind was in my ward recently in which a baby of seven months had never had a movement without preliminary injections. The abdomen became swollen every day, but subsided after an injection and the passage of a long catheter. No stricture could be felt. I have already referred to a case of W. E. Hughes's, in which there was enormous dilatation of the large bowel with persistent constipation. In some of these patients there may be constricting bands, or, as in a case of Cheever's, a congenital stricture.

Dietetic causes are more common. In sucklings it often arises from an unnatural dryness of the small residue which passes into the colon, and it may be very difficult to decide whether the fault is in the mother's milk or in the digestion of the child. Most probably it is the latter, as some babies may be persistently costive on natural or artificial foods. Too much casein in the milk is believed by some writers to be the cause. In older children it is of the greatest importance that regular habits should be enjoined. Carelessness on the part of the mother in this matter often lays the foundation of troublesome constipation in after life. Impairment of the contractibility of the intestinal wall in consequence of inflammation, disturbance in the normal intestinal secretions, and mechanical obstruction by tumors, twists, and intussusception are the chief local causes.

Treatment.—Much may be done by systematic habits, particularly in the young. The desire to go to stool should always be granted. Exercise in moderation is helpful. In stout persons and in women with pendulous abdomens the muscles should have the support of a bandage. Friction or regularly applied massage is invaluable in the more chronic cases. A good substitute is a metal ball weighing from four to six pounds, which may be rolled over the abdomen every morning for five or ten minutes. The diet should be light, with plenty of fruit and vegetables, particularly salads and tomatoes. Oatmeal is usually laxative, though not to all; brown bread is better than that made from fine white flour. Of liquids, water and the aërated mineral waters may be taken freely. A tumblerful of cold water on rising, taken slowly, is efficacious in many cases. A glass of hot water at night may also be tried alone. A pipe or a cigar after breakfast is with many men an infallible remedy.

When the condition is not very obstinate it is well to try to relieve it by hygienic and dietetic measures. If drugs must be used they should be the milder saline laxatives or the compound liquorice powder. Enemata are often necessary, and it is much preferable to employ them early than to constantly use purgative pills. Glycerine either in the form of suppository or as a small injection is very valuable. Half a drachm of boric acid placed within the rectum is sometimes efficacious. The injections of tepid water, with or without soap, may be used for a prolonged period with good effect and without damage. The patient should be in the

VIII. DISEASES OF THE LIVER.

1. JAUNDICE (*Icterus*).

dorsal position with the hips elevated, and it is best to let the fluid flow in slowly from a fountain syringe.

There are various drugs which are of special service, particularly the combination of ipecacuanha, nux vomica, or belladonna, with aloes, rhubarb, colocynth, or podophyllin. Meigs recommends particularly the combination of extract of belladonna (gr. $\frac{1}{12}$), extract of nux vomica (gr. $\frac{1}{4}$), and extract of colocynth (gr. ij), one pill to be taken three times a day. In anæmia and chlorosis a sulphur confection taken in the morning, and a pill of iron, rhubarb, and aloes throughout the day are very serviceable.

In children the indications should be met, as far as possible, by hygienic and dietetic measures. In the constipation of sucklings a change in the diet of the mother may be tried. Drinking of water, barley water, or oatmeal water will sometimes obviate the difficulty. If laxatives are required simple syrup, manna, or olive oil may be sufficient. The conical piece of soap, so often seen in nurseries, is sometimes efficacious. Small injections of cold water may be used. Large injections should be avoided if possible. If it is necessary to give a laxative by the mouth the castor oil or fluid magnesia is the best. If there are signs of gastro-intestinal irritation rhubarb and soda or gray powder may be given. In older children the diet should be carefully regulated.

VIII. DISEASES OF THE LIVER.

I. JAUNDICE (*Icterus*).

1. **Jaundice as a Symptom.**—Cases with icterus may be divided into two great groups: Those in which there is obstruction, either in the smaller or in the larger ducts—the *hepatogenous* form; cases in which the jaundice is due to suppression of the function of the liver-cells, as in the widespread necrosis of acute yellow atrophy, or to an excess of the chromatogenous material, as in malaria, pernicious anæmia, and certain fevers, in which the liver function cannot keep pace with the blood destruction (hæmolysis)—*hæmatogenous* or non-obstructive jaundice.

The following classification of the causes of hepatogenous jaundice is arranged by Murchison, to whose writings on the liver we owe so much: Obstruction (1) by foreign bodies within the ducts, as gall-stones and parasites; (2) by inflammatory tumefaction of the duodenum or of the lining membrane of the duct; (3) by stricture or obliteration of the duct; (4) by tumors closing the orifice of the duct or growing in its interior; (5) by pressure on the duct from without, as by tumors of the liver itself, of the stomach, pancreas, kidney, or omentum; by pressure of enlarged glands in the fissure of the liver, and, more rarely, of abdominal aneurism,

fæcal accumulation, or the pregnant uterus; (6) to these may be added lowering of the blood pressure in the liver, so that the tension in the smaller bile-ducts is greater than in the blood-vessels. In this class very probably may be placed the cases resulting from mental shock or depressing emotions.

General Symptoms of Obstructive Jaundice.—(1) Icterus, or tinting of the skin and conjunctivæ. The color ranges from a lemon-yellow in catarrhal jaundice to a deep olive-green or bronzed hue in permanent obstruction. In some instances the color of the skin is greenish black, the so-called "black jaundice."

(2) Of other cutaneous symptoms, pruritus in the more chronic forms may be intense and cause the greatest distress. It may precede the onset of the jaundice, but as a rule it is not very marked except in cases of prolonged obstruction. Sweating is common, and may be curiously localized to the abdomen or to the palms of the hands. Lichen, urticaria, and boils may develop, and the skin disease known as xanthelasma or vitiligoidea.

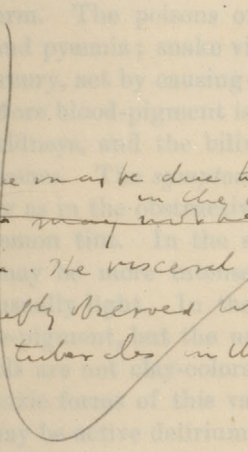
(3) The secretions are colored with bile-pigment. The sweat tinges the linen; the tears and saliva and milk are rarely stained. The expectoration is not often tinted unless there is inflammation, as when pneumonia coexists with jaundice. The urine may contain the pigment before it is apparent in the skin or conjunctiva. The color varies from light greenish yellow to a deep black-green. Gmelin's test is made by allowing five or six drops of urine and a similar amount of common nitric acid to flow together slowly on the flat surface of a white plate. A play of colors is produced—various shades of green, yellow, violet, and red. In cases of jaundice of long standing or great intensity the urine usually contains albumen and always bile-stained tube-casts.

(4) No bile passes into the intestine. The stools therefore are of a pale drab or slate-gray color, and usually very fetid and pasty. There may be constipation; in many instances, owing to decomposition, there is diarrhœa.

(5) Slow pulse. The heart's action may fall to 40, 30, or even to 20 per minute. It is particularly noticeable in the cases of catarrhal jaundice, and is not as a rule an unfavorable symptom.

(6) Hæmorrhage. Ecchymoses are not uncommon in severe jaundice, particularly in the more malignant forms.

(7) Cerebral symptoms. Irritability, great depression of spirits, or even melancholia may be present. In any case of persistent jaundice special nervous phenomena may develop and rapidly prove fatal—such as sudden coma, acute delirium, or convulsions. Usually the patient has a rapid pulse, slight fever, and a dry tongue, and he passes into the so-called "typhoid state." These features are not nearly so common in obstructive as in febrile jaundice, but they not infrequently terminate a chronic icterus in whatever way produced. The group of symptoms has been termed



The jaundice may be due to the presence of the Xanthomata in the bile passages
~~The Xanthomata may~~ not be secondary to the jaundice but vice versa. The visceral localization of Xanthomata has been chiefly observed when there are numerous punctuate tubercles in the lungs (Hall Sean)

Purpura. Large sub-cutaneous extravasations, more rarely hemorrhages from the mucous membrane occur in ~~the~~ protracted jaundice & in the more malignant forms

cholæmia or, on the supposition that cholesterin is the poison, *cholesteræmia;* but the true nature of the poison has not yet been determined. In some of the cases the symptoms may be due to uræmia.

Non-obstructive jaundice may be thus classified :

(1) The form in which there is wide-spread necrosis of the liver-cells and direct interference with their bile-forming function, as in acute yellow atrophy, and possibly in certain cases of hypertrophic cirrhosis. Strictly speaking, this is a hepatogenous jaundice.

(2) The toxic form. The poisons of yellow fever, malaria, typhoid, epidemic jaundice, and pyæmia; snake virus, as well as chloroform, ether, phosphorus, and mercury, act by causing increased destruction of the red blood-corpuscles. More blood-pigment is set free than can be disposed of by liver, spleen, or kidneys, and the bilirubin (transformed hæmoglobin) is deposited in the tissues. The *symptoms* of hæmatogenous jaundice are not nearly so striking as in the obstructive variety. The skin has in many cases only a light lemon tint. In the severer forms, as in acute yellow atrophy, the color may be more intense, but in malaria and pernicious anæmia the tint is usually light. In these mild cases the urine may contain little or no bile-pigment, but the urinary pigments are considerably increased. The stools are not clay-colored and may in some instances be very dark. In the toxic forms of this variety the cerebral symptoms are marked and there may be active delirium, coma, or convulsions.

2. **Icterus Neonatorum.**—New-born infants are liable to jaundice, which in some instances rapidly proves fatal. A mild and a severe form may be recognized.

The *mild icterus* of the new-born is a common disease in foundling hospitals and is not very infrequent in private practice. The discoloration appears early, usually on the first or second day, and is of moderate intensity. The urine may be bile-stained and the fæces colorless. The nutrition of the child is not seriously disturbed, and in the majority of cases the jaundice disappears within two weeks. It is supposed that the diminished pressure in the portal vessels, following the severance of the placental circulation, allows absorption from the bile capillaries, in which the tension is greater. Possibly too, as Quincke suggests, the ductus venosus may remain open, allowing some of the portal blood containing bile to flow into the systemic circulation. On the other hand, it is held that the jaundice is hæmatogenous and due to the destruction of large numbers of red blood-corpuscles during the first few days after birth.

The *severe form* of icterus in the new-born may depend upon (*a*) congenital absence of the common or hepatic duct, of which there are several instances on record; (*b*) congenital syphilitic hepatitis; and (*c*) septic poisoning, associated with phlebitis of the umbilical vein. This is a severe and fatal form, in which also hæmorrhage from the cord may occur.

Occasionally jaundice sets in and persists for many weeks, or even months, without interfering seriously with the nutrition of the child.

3. **Acute Yellow Atrophy of the Liver; Malignant Jaundice; Icterus Gravis.**

Definition.—Jaundice associated with marked cerebral symptoms and characterized anatomically by extensive necrosis of the liver-cells with reduction in volume of the organ.

Etiology.—This is a rare disease. In a somewhat varied post-mortem and clinical experience no instance has fallen under my observation. On the other hand, a physician may see several cases within a few years, or even within a few months, as happened to Riess, who saw five cases within three months at the Charité, in Berlin. The disease seems to be rare in this country. No case is reported in the Transactions of the Pathological Societies of New York (Vols. I to III) or of Philadelphia (Vols. I to XIII). The disease is more common in women than in men. Of the 100 cases collected by Legg, 69 were in females; and of Thierfelder's 143 cases, 88 were in women. There is a remarkable association between the disease and pregnancy, which was present in 25 of the 69 women in Legg's statistics, and in 33 of the 88 women in Thierfelder's collection. It is most common between the ages of twenty and thirty, but is occasionally seen in young children. It has followed fright or profound mental emotion. Though the symptoms produced by phosphorus poisoning closely simulate those of acute yellow atrophy, the two conditions are not identical.

Morbid Anatomy.—The liver is greatly reduced in size, looks thin and flattened, and sometimes does not reach more than one half or even one third of its normal weight. It is flabby and the capsule is wrinkled. On section the color is of a yellowish brown, yellowish red, or mottled, and the outlines of the lobules are indistinct. The yellow and dark-red portions represent different stages of the same process—the yellow an earlier, the red a more advanced stage. The organ may cut with considerable firmness. Microscopically the liver-cells are seen in all stages of necrosis, and in spots appear to have undergone complete destruction, leaving a fatty, granular *débris* with pigment grains and crystals of leucin and tyrosin. The interlobular tissue may be normal, but in many cases there is a marked proliferation of small cells, which was present in 9 of the 12 cases examined by Riess. Micro-organisms have been noted by several observers. The bile-ducts and gall-bladder are empty.

The other organs show extensive bile staining, and there are numerous hæmorrhages. The kidneys may show marked granular degeneration of the epithelium, and usually there is fatty degeneration of the heart. In a majority of the cases the spleen is enlarged.

Symptoms.—In the initial stage there is a gastro-duodenal catarrh, and at first the jaundice is thought to be of a simple nature. In some in-

Lenticular Typhoid are not however destructive
They may be present in cases of catarrhal jaundice
with slight enlargement of the liver. (Chalmers)
less acute.

stances this lasts only a few days, in others two or three weeks. Then severe symptoms set in—headache, delirium, trembling of the muscles, and, in some instances, convulsions. Vomiting is a constant symptom, and blood may be brought up. Hæmorrhages occur into the skin or from the mucous surfaces; in pregnant women abortion may occur. With the development of the head symptoms the jaundice usually increases. Coma sets in and gradually deepens until death. The body temperature is variable; in a majority of the cases the disease runs an afebrile course, though sometimes just before death there is an elevation. In some instances, however, there has been marked pyrexia. The pulse is usually rapid, the tongue coated and dry, and the patient is in a "typhoid state."

The urine is bile-stained and often contains tube-casts. Leucin and tyrosin are constantly present; the former as rounded disks, the latter in needle-shaped crystals, arranged either in bundles or in groups. The tyrosin may sometimes be seen in the urine sediment, but it is best first to evaporate a few drops of urine on a cover-glass. In the majority of cases no bile enters the intestines, and the stools are clay-colored. The disease is almost invariably fatal. In a few instances recovery has been noted. I saw in Leube's clinic, at Wurzburg, a case which was convalescent.

Diagnosis.—Jaundice with delirium, diminution of the liver volume, delirium, and the presence of leucin and tyrosin in the urine, form a characteristic and unmistakable group of symptoms.

It is not to be forgotten that any severe jaundice may be associated with intense cerebral symptoms. The clinical features in certain cases of hypertrophic cirrhosis are almost identical, but the enlargement of the liver, the more constant occurrence of fever, and the absence of leucin and tyrosin are distinguishing signs. Phosphorus poisoning may closely simulate acute yellow atrophy, particularly in the hæmorrhages, jaundice, and the diminution in the liver volume, but the gastric symptoms are usually more marked, and leucin and tyrosin are stated not to occur in the urine.

No known remedies have any influence on the course of the disease.

II. AFFECTIONS OF THE BLOOD-VESSELS OF THE LIVER.

(1) **Anæmia.**—On the post-mortem table, when the liver looks anæmic, as in the fatty or amyloid organ, the blood-vessels, which during life were probably well filled, can be readily injected. There are no symptoms indicative of this condition.

(2) **Hyperæmia.**—This occurs in two forms. (*a*) *Active hyperæmia.* After each meal the rapid absorption by the portal vessels induces transient congestion of the organ, which, however, is entirely physiological; but it is quite possible that in persons who persistently eat and drink too much

this active hyperæmia may lead to functional disturbance or, in the case of drinking too freely of alcohol, to organic change.

The *symptoms* of active hyperæmia are indefinite. Possibly the sense of distress or fulness in the right hypochondrium, so often mentioned by dyspeptics and by those who eat and drink freely, may be due to this cause. There are probably diurnal variations in the volume of the liver. In cirrhosis with enlargement the rapid reduction in volume after a copious hæmorrhage indicates the important part which hyperæmia plays even in organic troubles. It is stated that suppression of the menses or suppression of a hæmorrhoidal flow is followed by hyperæmia of the liver. Andrew H. Smith has described a case of periodical enlargement of the liver.

(*b*) *Passive Congestion.*—This is much more common and results from an increase of pressure in the efferent vessels or sub-lobular branches of the hepatic veins. Every condition leading to venous stasis in the right heart at once affects these veins.

In chronic valvular disease, in emphysema, cirrhosis of the lung, and in intrathoracic tumors mechanical congestion occurs and finally leads to very definite changes. The liver is enlarged, firm, and of a deep-red color; the hepatic vessels are greatly engorged, particularly the central vein in each lobule and its adjacent capillaries. On section the organ presents a peculiar mottled appearance, owing to the deeply congested hepatic and the anæmic portal territories; hence the term *nutmeg* which has been given to this condition. Gradually the distention of the central capillaries reaches such a grade that atrophy of the intervening liver-cells is induced. Brown pigment is deposited about the centre of the lobules and the connective tissue is greatly increased. In this cyanotic induration or cardiac liver the organ is large in the early stage, but later it may become contracted. Occasionally in this form the connective tissue is increased about the lobules as well, but the process usually extends from the sublobular and central veins.

The symptoms of this form are not always to be separated from those of the associated conditions. Gastro-intestinal catarrh is usually present and hæmatemesis may occur. The portal obstruction in advanced cases leads to ascites, which may precede the development of general dropsy. There is often slight jaundice, the stools may be clay-colored, and the urine contains bile-pigment.

On examination the organ is found to be increased in size. It may be a full hand's-breadth below the costal margin and tender on pressure. It is in this condition particularly that we meet with pulsation of the liver. We must distinguish the communicated throbbing of the heart, which is very common, from the heaving, diffuse impulse due to regurgitation into the hepatic veins, in which, when one hand is upon the ensiform cartilage and the other upon the right side at the margin of the ribs, the whole liver can be felt to dilate with each impulse.

The indications for *treatment* in passive hyperæmia are to restore the balance of the circulation and to unload the engorged portal vessels. In cases of intense hyperæmia eighteen or twenty ounces of blood may be directly aspirated from the liver, as advised by George Harley and practised by many Anglo-Indian physicians. Good results sometimes follow this hepato-phlebotomy. The prompt relief and marked reduction in the volume of the organ which follow an attack of hæmatemesis or bleeding from piles suggests this practice. Salts administered by Matthew Hay's method deplete the portal system freely and thoroughly. As a rule, the treatment must be that of the condition with which it is associated.

(3) **Diseases of the Portal Vein.**—(*a*) *Thrombosis; Adhesive Pylephlebitis.*—Coagulation of blood in the portal vein is rarely seen except in cirrhosis. Exceptional causes are invasion of the branches by cancer, proliferative peritonitis involving the gastro-hepatic omentum, and perforation of the vein by gall-stones. In rare instances a complete collateral circulation is established, the thrombus undergoes the usual changes, and ultimately the vein is represented by a fibrous cord, a condition which has been called *pylephlebitis adhesiva.* In a case of this kind which I dissected the portal vein was represented by a narrow fibrous cord; the collateral circulation, which must have been completely established for years, ultimately failed, ascites and hæmatemesis supervened and rapidly proved fatal.* The diagnosis of obstruction of the portal vein can rarely be made. A suggestive symptom, however, is a *sudden* onset of the most intense engorgement of the branches of the portal system.

Emboli in the branches of the portal vein do not, as a rule, produce infarction, for blood reaches the lobular capillary plexus, as shown by Cohnheim and Litten, through the free anastomosis with the hepatic artery. In rare instances, however, a condition resembling infarction does occur, sometimes in small areas, at others in quite extensive territories. Septic emboli, on the other hand, may induce suppuration.

(*b*) *Suppurative pylephlebitis* will be considered in the section on abscess.

(4) **Affections of the hepatic vein** are extremely rare. Dilatation occurs in cases of chronic enlargement of the right heart, from whatever cause produced. Emboli occasionally pass from the right auricle into the hepatic veins. A rare and unusual event is stenosis of the orifices of the hepatic veins, which I met in a case of fibroid obliteration of the inferior vena cava and was associated with a greatly enlarged and indurated liver.†

(5) **Hepatic Artery.**—Enlargement of this vessel is seen in cases of cirrhosis of the liver. It may be the seat of extensive sclerosis. Aneurism of the hepatic artery is rare, but instances are on record, and will be referred to in the section on arteries.

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* Journal of Anatomy and Physiology, vol. xvii.

† Ibid., vol. xvi.

III. DISEASES OF THE BILE-PASSAGES.

Catarrhal Jaundice.

Definition.—Jaundice due to swelling and obstruction of the terminal portion of the common duct.

Etiology.—General catarrhal inflammation of the bile-ducts is usually associated with gall-stones. The catarrhal process now under consideration is probably always an extension of a gastro-duodenal catarrh, and the process is most intense in the *pars intestinalis* of the duct, which projects into the duodenum. The mucous membrane is swollen, and a plug of inspissated mucus fills the diverticulum of Vater, and the narrower portion just at the orifice, completely obstructing the outflow of bile. It is not known how wide-spread this catarrh is in the bile-passages, and whether it really passes up the ducts. It would, of course, be possible to have a catarrh of the finer ducts within the liver, which some French writers think may initiate the attack, but the evidence of this is not strong, and it seems more likely that the terminal portion of the duct is always first involved. In the only instance which I have had an opportunity to examine post mortem the orifice was plugged with inspissated mucus, the common and hepatic ducts were slightly distended and contained a bile-tinged, not a clear, mucus, and there were no observable changes in the mucosa of the ducts.

This catarrhal or simple jaundice results from the following causes: (1) Duodenal catarrh, in whatever way produced, most commonly following an attack of indigestion. It is most frequently met with in young persons, but may occur at any age, and may follow not only errors in diet, but also cold, exposure, and malaria, as well as the conditions associated with portal obstruction, chronic heart-disease, and Bright's disease. (2) Emotional disturbances may be followed by jaundice, which is believed to be due to catarrhal swelling. Cases of this kind are rare and the anatomical condition is unknown. (3) Simple or catarrhal jaundice may occur in epidemic form. (4) Catarrhal jaundice is occasionally seen in the infectious fevers, such as pneumonia, and typhoid fever.

Symptoms.—There may be neither pain nor distress, and the patient's friends may first notice the yellow tint, or the patient himself may observe it in the looking-glass. In other instances there are dyspeptic symptoms and uneasy sensations in the hepatic region or pains in the back and limbs. In the epidemic form, the onset may be more severe, with headache, chill, and vomiting. Fever is rarely present, though the temperature may reach 101°, sometimes 102°. All the signs of obstructive jaundice already mentioned are present, the stools are clay-colored, and the urine contains bile-pigment. The jaundice has a bright-yellow tint; the greenish, bronzed color is never seen in the simple form. The pulse may be normal, but occasionally it is remarkably slow, and may fall

to forty or thirty beats in the minute. The liver may be normal in size, but is usually slightly enlarged, and the edge can be felt below the costal margin. Occasionally the enlargement is more marked. The duration of the disease is from four to eight weeks. There are mild cases in which the jaundice disappears within two weeks; on the other hand, it may persist for three months. The stools should be carefully watched, for they give the first intimation of removal of the obstruction.

The *diagnosis* is rarely difficult. The onset in young, comparatively healthy persons, the moderate grade of icterus, the absence of emaciation or of evidences of cirrhosis or cancer, usually make the diagnosis easy. Cases which persist for two and three months cause uneasiness, as the suspicion is aroused that it may be more than simple catarrh. The absence of pain, the negative character of the physical examination, and the maintenance of the general nutrition are the points in favor of simple jaundice. There are instances in which time alone can determine the true nature of the case.

Treatment.—As a rule the patient can keep on his feet from the outset. Measures should be used to allay the gastric catarrh, if it is present. A dose of calomel may be given, and the bowels kept open subsequently by salines. The patient should not be violently purged. Bismuth and bicarbonate of soda may be given, and the patient should drink freely of the alkaline mineral waters, of which Vichy is the best. Irrigation of the large bowel with cold water may be practised. The cold is supposed to excite peristalsis of the gall-bladder and ducts, and thus aid in the expulsion of the mucus. This practice has been followed in my wards for several years, but I cannot speak warmly of the results.

Cholelithiasis (*Gall-Stones*).

Calculi are formed in the gall-bladder. Evidence is wanting to show that they are formed within the liver ducts, except in very rare instances. They may be single, in which case the stone is usually ovoid and may attain a very large size. Instances are on record of gall-stones measuring more than five inches in length. They may be extremely numerous, ranging from a score to several hundreds or even several thousands, in which case the stones are very small. When moderately numerous, they show signs of mutual pressure and have a polygonal form, with smooth facets; occasionally, however, five or six gall-stones of medium size are met with in the bladder which are round or ovoid and without facets. They are sometimes mulberry-shaped and very dark, consisting largely of bile-pigment. Again there are small, black calculi, rough and irregular in shape, and varying in size from sand to small shot. These are sometimes known as gall-sand. On section, a calculus contains a nucleus, which consists of bile-pigment, rarely a foreign body. The greater portion of the stone is made up of cholesterin, which may form the entire calculus and is ar-

ranged in concentric laminæ showing also radiating lines. Salts of lime and magnesia, bile acids, fatty acids, and traces of iron and copper are also found in them. A majority of gall-stones consist of from seventy to eighty per cent of cholesterin, in either the amorphous or the crystalline form. As above stated, it is sometimes pure, but more commonly it is mixed with the bile-pigment. The outer layer of the stone is usually harder and brownish in color, and contains a larger proportion of lime salts.

The mode of formation is by no means clear. A defect in the sodium salts seems to favor the precipitation of the cholesterin and of the bile-pigment. The lime exists in such slight quantities in the bile that it is probably a pathological product of the mucous glands of the gall-bladder. When the bile is retained long in the gall-bladder its concentration favors the deposition.

Etiology.—Three fourths of the cases of gall-stones occur in women, most frequently between the ages of thirty and sixty. Sedentary occupations, particularly when combined with overindulgence in eating, seem important factors. The subjects are often stout, and usually very fond of starchy and saccharine food. The conditions which induce lithic acid also favor the development of gall-stones. Tight-lacing is regarded by Marchand as an important factor in retarding the flow of the bile. Pregnancy has a similar influence. Naunyn states that ninety per cent of women with gall-stones have borne children. Constipation and depressing mental influences have been regarded as favoring circumstances.

Symptoms.—In a majority of the cases, gall-stones cause no symptoms. The gall-bladder will tolerate the presence of large numbers for an indefinite period of time, and post-mortem examinations show that they are present in twenty-five per cent of all women over sixty years of age (Naunyn).

The effects of gall-stones may be considered under the following headings: The symptoms produced by the passage of a stone through the ducts—biliary colic; the effects of permanent plugging of the duct; and the more remote effects, due to ulceration and perforation, and the establishment of fistulæ.

1. **Biliary Colic.**—It would appear that gall-stones may become engaged in the cystic or the common duct without producing pain or severe symptoms. More commonly the passage of a stone excites the violent symptoms known as biliary colic. The attack sets in abruptly with agonizing pain in the right hypochondriac region, which radiates to the shoulder, or is very intense in the epigastric and in the lower thoracic regions. It is often associated with a rigor and a rise in temperature from 102° to 103°. The pain is usually so intense that the patient rolls about in agony. There are vomiting, profuse sweating, and great depression of the circulation. There may be marked tenderness in the region of the liver, which may become enlarged. In a large number of the cases jaundice

The spleen may also be enlarged (Naunyn) and the urine may present albumin + red blood corpuscles, casts and when the fever indicate a cholecystitis acuta + slight systemic infection (Oliver)

The muscles may be very painful — cheeks (walker) & pedestrians

A case of which I saw
(see 1st Thayer's copy grey book.)

Patient with a series of convulsive seizures in connection with cholelithiasis in March 7. Nov. 1894

Pseudo-hepatic colic is not unfrequently met with in nervous women and the diagnosis of gall stones made. These nervous hepatic colic may be periodical, the pain in right side & radiating sometimes associated with other nervous phenomena, often excited by emotion or fatigue or excesses. The liver may be tender but there can not be either icterus or inflammatory conditions. There are cases in which for years patients have at intervals pain in the liver region. I knew an Aberdeen Professor who had attacks of pseudo-colic for more than twenty years.

A remarkable thickening of the bile passages has been found in association with hepatic colic

develops, but it is not a necessary symptom. Of course it does not occur during the passage of the stone through the cystic duct, but only when it becomes lodged in the common duct. Probably the intense pain is due to the slow progress in the cystic duct, in which the stone takes a rotary course owing to the arrangement of the Heisterian valve.

The attack varies in duration. It may last for a few hours, several days, or even a week or more. If the stone becomes impacted in the orifice of the common duct, the jaundice becomes intense; much more commonly it is a slight, transient icterus. The attack of colic may be repeated at intervals for some time, but finally the stone passes and the symptoms rapidly disappear.

Occasionally accidents occur, such as rupture of the duct with fatal peritonitis. Syncope, owing to the intensity of the pain, may follow and has been known to prove fatal, and epilepsy has been seen. These are, however, rare events. Palpitation and distress about the heart may be present, and occasionally a mitral murmur develops during the paroxysm; but the cardiac conditions described by some writers as coming on acutely in biliary colic are probably pre-existent in these patients.

The *diagnosis* of acute hepatic colic is generally easy. The pain is in the upper abdominal and thoracic regions, whereas the pain in nephritic colic is in the lower abdomen. A chill, with fever, is much more frequent in biliary colic than in gastralgia, with which it is liable, at times, to be confounded. A history of previous attacks is an important guide, and the occurrence of jaundice, however slight, determines the diagnosis. To look for the gall-stones, the stools should be thoroughly mixed with water and carefully filtered through a narrow-meshed sieve.

2. **Chronic Obstruction of the Ducts by Gall-stones.**—*Of the Cystic Duct.*—The effects may be thus enumerated:

Dilatation of the gall-bladder—hydrops vesicæ felleæ. This occurs much more frequently than in obstruction of the common duct. The fluid is almost invariably of a thin mucoid nature, though it may be mixed with bile. In all cases, when the obstruction persists, the bile is replaced by a clear fluid. This is an important point in diagnosis, particularly as a dropsical gall-bladder may form a very large tumor. The reaction is not always constant. It is either alkaline or neutral; the consistence is thin and mucoid. Albumen is usually present. The organ may reach an enormous size, and in one instance Tait found it occupying the greater part of the abdomen. In such cases, as is not unnatural, it has been mistaken for an ovarian tumor. In one of my cases it was adherent to the broad ligament, and had been mistaken for a cyst of the left ovary. The dilated gall-bladder can usually be felt below the edge of the liver, and in many instances it has a characteristic outline like a gourd. It usually projects directly downward, rarely to one side or the other, though occasionally toward the middle line. It may reach below the navel, and in persons with thin walls the outline can be accurately

defined. It is to be remembered that distention of the gall-bladder may occur without jaundice; indeed, the greatest enlargement has been met with in such cases.

In obstruction of the common duct the gall-bladder is not necessarily greatly enlarged. Occasionally it may be much distended without the occurrence of any tumor which can be felt during life. In one case (operation) eighteen ounces were removed from a gall-bladder, the edge of which barely projected below the margin of the right lobe.

Acute phlegmonous cystitis. This is a rare event. Only seven instances of it have been collected in the enormous statistics of Courvoisier. In a case which I have reported the patient died on the fifth day with symptoms of the most intense prostration, fever, and abdominal pain. Perforation may occur with fatal peritonitis.

Suppurative cholecystitis, empyema of the gall-bladder, is much more common, and in the great majority of cases is associated with gall-stones —41 in 55 cases (Courvoisier). There may be enormous dilatation, and over a litre of pus has been found. Perforation and the formation of abscesses in the neighborhood are not uncommon.

Calcification of the gall-bladder is commonly a termination of the previous condition. There are two separate forms, incrustation of the mucosa with lime salts and the true infiltration of the wall with lime, the so-called ossification. A remarkable example of the latter sent to me by Groves, of Carp, is now in the McGill Medical Museum.

Atrophy of the gall-bladder. This is by no means uncommon. The organ shrinks into a small fibroid mass, not larger, perhaps, than a good-sized pea or walnut, or even has the form of a narrow fibrous string; more commonly the gall-bladder tightly embraces a stone. This condition is usually preceded by hydrops of the bladder. In an interesting case of the kind, the patient, ~~nearly twenty~~ years before, had had an obscure abdominal tumor, which caused so much difference of opinion among his physicians that instruction was left in his will that the body should be examined. The gall-bladder was entirely obliterated and closely encircled a large gall-stone.

Occasionally the gall-bladder presents diverticula, which may be cut off from the main portion, and usually contain calculi.

Obstruction of the Common Duct.

The stone usually lies at the termination of the duct, just at the orifice of the papilla, within a sort of pouch formed by the diverticulum of Vater. Examined from the duodenum, it seems to be directly beneath the mucosa. It is as a rule single; but two and, in some instances, a series of stones may occupy the entire duct. The effect of the obstruction is dilatation, with catarrhal or suppurative cholangitis.

(1) Obstruction, with catarrhal cholangitis.

The common duct may be as large as the thumb; the hepatic duct and its branches through the liver are greatly dilated, and the distention may

Gall-stone crepitus is felt when the bladder is very full of stones & the walls not very tense. It is rarely well felt unless the abdominal walls are very much relaxed. There may be no signs. It may be met with in patients who have never had any symptoms of cholelithiasis

Elliot.

The itching may be most intense

but it has been described as
(Peal)

even be apparent beneath the liver capsule. Great enlargement of the gall-bladder is rare. The mucous membrane of the ducts may be smooth and clear, and the contents a thin, colorless mucus.

Catarrhal cholangitis with gall-stones is characterized by a special symptom group: (*a*) Ague-like paroxysms, chills, fever, and sweating; (*b*) jaundice of varying intensity, which persists for months or even years, and deepens after each paroxysm; (*c*) at the time of the paroxysms, pains in the region of the liver with gastric disturbance. These symptoms may continue on and off for three or four years, without the development of suppurative cholangitis. In one of my cases the jaundice and recurring hepatic intermittent fever existed from July, 1879, until August, 1882; the patient recovered and still lives. The condition has lasted from eight months to three years. The rigors are of intense severity, and the temperature rises to 103° or 105°. The chills may recur daily for weeks, and present a tertian or quartan type, so that they often are mistaken for malaria, with which, however, they have no connection. The jaundice is variable, and deepens after each paroxysm. Pain, which is sometimes intense and colicky, does not always occur. There may be marked vomiting and nausea. As a rule there is no progressive deterioration of health. In the intervals between the attacks the temperature is normal.

The clinical history and the post-mortem examinations in my cases* have shown conclusively that this condition may persist for years without a trace of suppuration within the ducts.

The nature of the hepatic intermittent fever is not settled. Charcot holds that it is due to the production of a ferment in the bile-passages, and a bacillus, probably the *bacterium coli commune*, has been found in the ducts in several cases. Both Murchison and Ord hold that it is simply due to local irritation of the mucous membrane, and that the fever is really of a nervous character.

The effect upon the liver of chronic obstruction of the bile-duct is very variable. The organ is rarely enlarged. ~~It is~~ firm ~~and the~~ connective tissue ~~is~~ moderately increased. In none of my cases of persistent obstruction by gall-stones was the liver greatly enlarged, nor did it present macroscopically the features of cirrhosis. On this point my experience is in accord with that of Sharkey, who has recently called in question the statements of Charcot and Wickham Legg as to the occurrence of cirrhosis under these circumstances.

(2) Obstruction, with suppurative cholangitis.

When suppurative cholangitis exists the mucosa is thickened, often eroded or ulcerated; there may be extensive suppuration in the ducts throughout the liver, and even empyema of the gall-bladder. Occasionally

* On Fever of Hepatic Origin, particularly the Intermittent Pyrexia associated with Gall-stones, Johns Hopkins Hospital Reports, vol. ii, No. 1, 1890; and in Annals of Surgery, 1890.

the suppuration extends beyond the ducts, and there is localized liver abscess, or there is perforation of the gall-bladder with the formation of abscess between the liver and stomach.

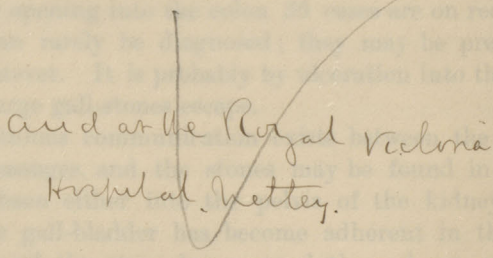
Clinically it is characterized by a fever which may be intermittent, but more commonly is remittent and without prolonged intervals of apyrexia. The jaundice is rarely so intense, nor do we see the deepening of the color after the paroxysms. There is usually greater enlargement of the liver and tenderness and more definite signs of septicæmia. The cases run a shorter course, and recovery never takes place.

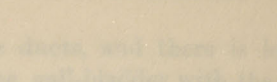
3. **The More Remote Effects of Gall-stones.** — (*a*) Biliary Fistulæ. These are not uncommon. There may, for instance, be abnormal communication between the gall-bladder and the hepatic duct or the gall-bladder and a cavity in the liver itself. More rarely perforation occurs between the common duct and the portal vein. Of this there are at least four instances on record, among them the celebrated case of Ignatius Loyola. Perforation into the abdominal cavity is not uncommon; 119 cases exist in the literature (Courvoisier), in 70 of which the rupture occurred directly into the peritoneal cavity; in 49 there was encapsulated abscess. Perforation may take place from an intrahepatic branch or from the hepatic, common, or cystic ducts. Perforation from the gall-bladder is the most common.

Fistulous communications between the bile-passages and the gastro-intestinal canal are frequent. Openings into the stomach are rare. Between the duodenum and bile-passages they are much more common. Courvoisier has collected 10 instances of communication between the ductus communis and the duodenum, and 73 cases between the gall-bladder and the duodenum. Communication with the ileum and jejunum is extremely rare. Of fistulous opening into the colon 39 cases are on record. These communications can rarely be diagnosed; they may be present without any symptoms whatever. It is probably by ulceration into the duodenum or colon that the large gall-stones escape.

Occasionally fistulous communication exists between the gall-bladder and the urinary passages, and the stones may be found in the bladder. The opening has been either into the pelvis of the kidney or, as has been supposed, the gall-bladder has become adherent in the neighborhood of the navel, and the stone has escaped through an open urachus. It is possible that adhesions may form between the distended gall-bladder and urinary bladder, since the former has been found adherent as low as the broad ligament.

Many instances are on record of fistulæ between the bile-passages and the lungs. Courvoisier has collected twenty-four cases. Bile may be coughed up with the expectoration, sometimes in considerable quantities. In only seven cases did recovery take place. In some of these the abscess formation was due to hydatids, in some to ascarides. The perforation usually takes place through the lung, by a liver abscess communicating with


and at the Royal Victoria
Hospital, Netley.


Peabody specimens
with pus (?)

the pleura, or occasionally the abscess enters the mediastinum and perforates a bronchus.

Of all fistulous communications the external or cutaneous is the most common. Courvoisier's statistics number 184 cases, in fifty per cent of which the perforation took place in the right hypochondrium; in twenty-nine per cent in the region of the navel. The number of stones discharged varied from one or two to many hundreds. Recovery took place in 78 cases; some with, some without operation.

(*b*) Obstruction of the bowel by gall-stones. Reference has already been made to this, the frequency which appears from the fact that of 295 cases of obstruction, occurring during the past eight years, analyzed by Fitz, 23 were by gall-stone. Courvoisier's statistics give a total number of 131 cases, in six of which the calculi had a peculiar situation, as in a diverticulum or in the appendix. Of the remaining 125 cases, in 70 the stone was spontaneously passed, usually with severe symptoms. The post-mortem reports show that in some of these cases even very large stones have passed *per viam naturalem*, as the gall-duct has been enormously distended, its orifice admitting the finger freely. This, however, is extremely rare. The stones have been found most commonly in the ileum.

Other Affections of the Bile-ducts.

Cancer will be considered later.

Stenosis or complete occlusion may follow ulceration, most commonly after the passage of a gall-stone. In these instances the obstruction is usually situated low down in the common duct. Instances of this are extremely rare. Foreign bodies, such as the seeds of various fruits, may enter the duct, and occasionally round worms crawl into it. In the Wistar-Horner Museum of the University of Pennsylvania there is a remarkable specimen showing the common and hepatic ducts enormously distended and densely packed with a dozen or more lumbricoid worms. A similar specimen exists in one of the Paris museums. Liver-flukes and echinococci are rare causes of obstruction in man.

Obstruction by *pressure* from without is more frequent. Naturally cancer of the head of the pancreas is apt to involve the terminal portion of the duct; less often cancer of the pylorus. Secondary involvement of the lymph glands of the liver is a common cause of occlusion of the duct, and is met with in many cases of cancer of the stomach and other abdominal organs. Rare causes of obstruction are aneurism of a branch of the cœliac axis or of the aorta, or pressure of very large abdominal tumors.

The symptoms produced are those of chronic obstructive jaundice. At first, the liver is usually enlarged, but in chronic cases it may be reduced in size, and of a deeply bronzed color, ~~and firm, owing to slight increase in the connective tissue~~. The hepatic intermittent fever may be associated with occlusion of the duct from any cause, but it is most fre-

quently met with in chronic obstruction by gall-stones. Permanent occlusion of the duct terminates in death. In a majority of the cases the conditions which lead to the obstruction are in themselves fatal. Cases of cicatricial occlusion may last for years. A patient under my care, who was permanently jaundiced for nearly three years, had a fibroid occlusion of the duct.

The *diagnosis* of the nature of the occlusion is often very difficult. A history of colic, jaundice of varying intensity, paroxysms of pain, and intermittent fever point to gall-stones. In cancerous obstruction the tumor mass can sometimes be felt in the epigastric region. In cases in which the lymph glands in the transverse fissure are cancerous, the primary disease may be in the pelvic organs or the rectum, or there may be a limited cancer of the stomach, which has not given any symptoms. In these cases the examination of the other lymphatic glands may be of value. In a case, recently under observation, with jaundice of seven weeks' duration, and believed to be catarrhal (as the patient's general condition was good and he was said not to have lost flesh), a small nodular mass was detected at the navel, which on removal proved to be scirrhus. Involvement of the clavicular groups of lymph glands may also be serviceable in diagnosis. As already mentioned, the gall-bladder is often but little enlarged in obstruction of the common duct. Great and progressive enlargement of the liver with jaundice and moderate continued fever is more commonly met with in cancer. In hypertrophic cirrhosis a similar condition exists, but the organ is smooth and there is rarely progressive enlargement while under observation.

Treatment of Gall-stones and their Effects.—In an attack of biliary colic the patient should be kept under morphia, given hypodermically, in quarter-grain doses. In an agonizing paroxysm it is well to give a whiff or two of chloroform until the morphia has had time to act. Great relief is experienced from the hot bath and from fomentations in the region of the liver. The patient should be given laxatives and should drink copiously of alkaline mineral waters. Olive oil has proved useless in my hands. When taken in large quantities, fatty concretions are passed with the stools, which have been mistaken for calculi. Since the days of Durande, whose mixture of ether and turpentine is still largely used in France, various remedies have been advised to dissolve the stones within the gall-bladder, none of which are efficacious.

The diet should be regulated, the patient should take regular exercise and avoid, as much as possible, the starchy and saccharine foods. The soda salts recommended by Prout are believed to prevent the concentration of the bile and the formation of gall-stones. Either the sulphate or the phosphate may be taken in doses of from one to two drachms daily.

Expression of gall-stones from the bladder by digital manipulation, as recommended by George Harley, is a highly irrational procedure, not to be followed. So long as gall-stones remain in the bladder they do little

and excretions due to eating pears have been
mistaken - particularly when associated with
the attacks

For the intense itching starch powder, strong
alkaline baths, pilocarpin hypodermically 1/8 - 1/6
and antipyrin (grs XIII) may be tried

or no harm in a great majority of cases. To force them on into the duct is to render the patient liable to severe colic or to the still more serious danger of permanent obstruction.

When the cystic duct is occluded and the gall-bladder distended, an exploratory puncture may be made, as practised by the elder Pepper, in 1857, in a case of empyema of the gall-bladder, and by Bartholow in 1878. The puncture may be made either to draw off fluid from a distended bladder or to explore for gall-stones. Aspiration is usually a safe procedure, though a fatal result has followed. When the gall-bladder is distended and plainly palpable, to sound for stones by an exploratory puncture is justifiable, but under no other circumstances. "The easy and safe method of sounding for impacted stones," recommended a few years ago by a London physician, in which it is advised to thrust a sharp needle six inches long between the navel and the margin of the liver, may be characterized as one of the most extraordinary operations ever advocated, and would probably always prove fatal, as in the case of the unhappy victim upon whom it was practised.

The surgical treatment of gall-stones has of late years made rapid progress. The operation of cholecystotomy, or opening the gall-bladder and removing the stones, which was advised by Sims, has been remarkably successful, particularly in the hands of Lawson Tait. The removal of the gall-bladder, cholecystectomy, has also been practised with success. The indications for operation are: (*a*) Repeated attacks of gall-stone colic, of great severity and danger. (*b*) The presence of a distended gall-bladder, associated with attacks of pain or with fever. Many cases of obstruction of the cystic duct with moderate distention of the gall-bladder produce little or no inconvenience, and perfect recovery may take place with contraction and obliteration. (*c*) When a gall-stone is permanently lodged in the common duct, and presents the group of symptoms above described. It must, however, be borne in mind that, contrary to the experiences of Charcot and other French writers, three of my cases recovered—one after persistence of the condition for eight months, another for three years; two died of the effects of the prolonged jaundice, and two after operation. The question, then, of advising removal in such cases should depend largely upon the personal methods and success of the surgeon who is available. The common duct has been explored and gall-stones removed from it. The operation is necessarily much more serious and difficult than that upon the gall-bladder.

IV. CIRRHOSIS.

Definition.—A chronic disease of the liver, characterized by a gradual destruction of liver-cells and an overgrowth of connective-tissue elements, in consequence of which the organ becomes hard and usually small.

Etiology.—The disease occurs most frequently in middle-aged males. It has been regarded as rare in children, except in the syphilitic form, but Palmer Howard collected 63 cases, to which list Hatfield, in a further search of the literature, has been able to add 93, so that its occurrence in early life is more common than has been supposed.

The following are the recognized factors in inducing the disease: (*a*) *Alcohol.*—The abuse of spirits is the common cause. It is more frequent in countries in which strong spirits are taken than in those in which malt liquors and wines are used. The change results from the irritative effect of the strong solution of alcohol absorbed from the stomach. The fusel oil is thought to be the offending material. Similar effects are doubtless produced by other substances, such as rich, highly seasoned foods, or, as has been suggested, by ptomaines and other alkaloids.

(*b*) *Syphilis.*—We have already considered (under Syphilis) the forms of cirrhosis, diffuse and gummatous, produced by this poison.

(*c*) *Cyanotic Congestion.*—In cases of chronic disease of the heart and lungs the liver is in a condition of persistent venous hyperæmia, in consequence of which the central cells of the liver lobules atrophy and there is hyperplasia of the connective tissue.

(*d*) *Malaria.*—Sclerosis of the liver may follow prolonged malarial poisoning. In this country it is very rare.

(*e*) *Tuberculosis.*—We have already referred to the sclerotic changes in the liver produced by tuberculosis. It rarely, if ever, induces a condition which can be recognized clinically.

(*f*) *Scarlet Fever.*—The fact noted by Klein that in scarlet fever there was an infiltration with small cells, an acute interstitial hepatitis, gives a clew to the occurrence of some of the cases of cirrhosis of the liver in children. In other infectious diseases, too, such as typhoid, there are localized necrotic areas which must be replaced by connective tissue. In the cirrhosis of early life, excluding the alcoholic and syphilitic cases, the acute infectious diseases are probably the important antecedents.

(*g*) *Rickets.*—The enlargement of the liver in this disease is associated with increase in the connective tissue, which surrounds the individual lobules and produces changes in the bile-ducts (Hodgben).

(*h*) *Anthracosis.*—It occasionally happens in coal-miners that the carbon pigment reaches the liver in large quantities, is deposited in the connective tissue about the portal canal, and may lead to a variety of cirrhosis, which has been described by Welch.

In animals, artificial obstruction of the bile-passages results in cirrhosis, but in man there may be persistent stenosis of the common duct or ob-

struction without marked increase in the connective tissue. The causes which induce the cirrhosis which we meet at the bedside are alcohol and syphilis.

Morbid Anatomy.—Practically on the post-mortem table we see cirrhosis in four well-characterized forms:

(*a*) *The Atrophic Cirrhosis of Laennec.*—The organ is greatly reduced in size and may be deformed. The weight is sometimes not more than a pound or a pound and a half. It presents numerous granulations on the surface; is firm, hard, and cuts with great resistance. The substance is seen to be made up of greenish-yellow islands, surrounded by grayish-white connective tissue. This yellow appearance of the liver induced Laennec to give it the name of cirrhosis.

(*b*) *Fatty Cirrhosis.*—Even in the atrophic form the fat is increased, but in typical examples of this variety the organ is not reduced in size, but is enlarged, smooth or very slightly granular, anæmic, yellowish white in color, and resembles an ordinary fatty liver. It is, however, firm, cuts with resistance, and microscopically shows a great increase in the connective tissue. This form is quite as common in this country as the atrophic variety. It occurs most frequently in beer-drinkers.

(*c*) *Hypertrophic Cirrhosis.*—Enlargement of the liver occurs in the early stage of the ordinary atrophic cirrhosis, but the increase is moderate and largely due to hyperæmia. The fatty cirrhotic liver is also large, and may reach a hand's-breadth below the costal margin. The term hypertrophic cirrhosis should be restricted to the form described by French writers, which is also known as *biliary* cirrhosis. Unfortunately, this has been used by some writers to include as well the cases in which there has been permanent occlusion of the duct, either by stricture or a calculus; the induration, however, is slight under these circumstances and hypertrophy very rare. It seems best to limit the terms *biliary* and *hypertrophic* cirrhosis to the form characterized by permanent enlargement of the liver, a marked involvement of the smaller biliary canaliculi, and retention in an unusual degree, in comparison with atrophic cirrhosis, of the number and form of the liver-cells, in spite of the great increase of the lobular connective tissue. In this form the liver is greatly enlarged; in one of my cases it weighed seven pounds. The surface is smooth, it is exceedingly firm, resists cutting, and presents on section a deep greenish-yellow color. All of my cases have been in hard drinkers.

(*d*) *Perihepatitis; Glissonian Cirrhosis.*—In this form the liver is greatly reduced in size, much altered in shape, and everywhere surrounded by a firm grayish-white membrane, sometimes of semi-cartilaginous consistence, varying from 10 to 15 mm. in thickness. This fibrous investment can be stripped off readily, and the liver substance may look almost normal, but usually shows cirrhotic changes. The capsular thickening may be slight, and the portal connective tissue chiefly involved. The capsule of the spleen is, as a rule, similarly affected, and both processes are asso-

ciated with a proliferative peritonitis. The condition is most frequent as a result of alcohol, but occurs also in instances of cyanotic induration.

The two essential elements in cirrhosis are destruction of liver-cells and obstruction to the portal circulation.

In an autopsy on a case of atrophic cirrhosis the peritonæum is usually found to contain a large quantity of fluid, the membrane is opaque, and there is chronic catarrh of the stomach and of the small intestines. The kidneys are sometimes cirrhotic, the bases of the lungs may be much compressed by the ascitic fluid, the heart often shows marked degeneration, and arterio-sclerosis is usually present. A remarkable feature is the association of acute tuberculosis with cirrhosis. In seven cases of my series the patients died with either acute tuberculous peritonitis or acute tuberculous pleurisy. Pitt states that twenty-two and a half per cent of the cases of cirrhosis dying in Guy's Hospital during twelve years had acute tuberculosis.

The compensatory circulation is usually readily demonstrated. It is carried out by the following set of vessels: (1) The accessory portal system of Sappey, of which important branches pass in the round and suspensory ligaments and unite with the epigastric and mammary systems. These vessels are numerous and small. Occasionally a large single vein, which may attain the size of the little finger, passes from the hilus of the liver in the round ligament, and joins the epigastric veins at the navel. Although this has the position of the umbilical vein, it is usually, as Sappey showed, a para-umbilical vein—that is, an enlarged vein by the side of the obliterated umbilical vessel. There may be produced about the navel a large bunch of varices, the so-called caput Medusæ. Other branches of this system occur in the gastro-epiploic omentum, about the gall-bladder, and, most important of all, in the suspensory ligament. These latter form large branches, which anastomose freely with the diaphragmatic veins, and so unite with the vena azygos. (2) By the anastomosis between the œsophageal and gastric veins. The veins at the lower end of the œsophagus may be enormously enlarged, producing varices which project on the mucous membrane. (3) The communications between the hæmorrhoidal and the inferior mesenteric veins. The freedom of communication in this direction is very variable, and in some instances the hæmorrhoidal veins are not much enlarged. (4) The veins of Retzius, which unite the radicles of the portal branches in the intestines and mesentery with the inferior vena cava and its branches. To this system belong the whole group of retroperitoneal veins, which are in most instances enormously enlarged, particularly about the kidneys, and which serve to carry off a considerable proportion of the portal blood.

Symptoms.—(*a*) *Of the Atrophic Form.*—The most extreme grade of atrophic cirrhosis may exist without symptoms. *So long as the compensatory circulation is maintained* the patient may suffer little or no inconvenience. The remarkable efficiency of this collateral circulation is well

Melaena may occur without haematemesis -

Case 560 Surg. P. Mr. notes man aged 38 died of acute Pneumonia. For 2½ years he had had attacks of haemorrhage from the bowels sometimes quite active enough to lay him up - several pints Pm. The stomach and duod were normal. The liver was a little large fatty, cut with resistance & was sclerotic the increase in connect tissue well marked.

Retinal haemorrhage, retinitis pigmentosa and xanthoma ~~have been~~ are occasional complications

seen in those rare instances of permanent obliteration of the portal vein, which may exist for many years.

The symptoms may be divided into two groups—obstructive and toxic.

Obstructive.—The overfilling of the blood-vessels of the stomach and intestine leads to chronic catarrh, and the patients suffer with nausea and vomiting, particularly in the morning; the tongue is furred and the bowels are irregular. Hæmorrhage from the stomach may be an early symptom; it is often profuse and liable to recur. It seldom proves fatal. The amount vomited may be remarkable, as in a case already referred to, in which ten pounds were ejected in seven days. Following the hæmatemesis melæna is common. Enlargement of the spleen occurs from the chronic congestion. The organ can usually be felt. Evidences of the establishment of the collateral circulation are seen in the enlarged epigastric and mammary veins, more rarely in the presence of the caput Medusæ and in the development of hæmorrhoids. The distended venules in the lower thoracic zone along the line of attachment of the diaphragm are not specially marked in cirrhosis. The most striking feature of failure in the compensatory circulation is ascites, the effusion of serous fluid into the peritoneal cavity. The conditions under which this occurs are still obscure. The abdomen gradually distends, may reach a large size, and contain as much as 15 or 20 litres. Œdema of the feet may precede or develop with the ascites. The dropsy rarely becomes general.

Jaundice is usually slight, and was present in only 35 of 130 cases of cirrhosis reported by Fagge. The skin has frequently a sallow, slightly icteroid tint. The urine is often reduced in amount, contains urates in abundance, often a slight amount of albumen, and, if jaundice is intense, tube-casts. The disease may be afebrile throughout, but in many cases, as shown by Carrington, there is slight fever, from 100° to 102·5°.

Examination in the early stage of the disease may show moderate enlargement of the liver, which may be painful on pressure. At this period the patient may come under observation for dyspepsia, hæmatemesis, slight jaundice, or nervous symptoms. Later in the disease, the patient has an unmistakable hepatic facies; he is thin, the eyes are sunken, the conjunctivæ watery, the nose and cheeks show distended venules, and the complexion is muddy or icteroid. On the enlarged abdomen the vessels are distended, and a bunch of dilated veins may surround the navel. When much fluid is in the peritonæum it is impossible to make a satisfactory examination, but after withdrawal the area of liver dulness is found to be diminished, particularly in the middle line, and on deep pressure the edge of the liver can be detected, and occasionally the hard, firm, and even granular surface. The spleen can be felt in the left hypochondriac region. Examination of the anus may reveal the presence of hæmorrhoids.

Toxic Symptoms.—At any stage of atrophic cirrhosis the patient may develop cerebral symptoms, either a noisy, joyous delirium, or stupor, coma, or even convulsions. The condition is not infrequently mistaken for

uræmia. The nature of the toxic agent is not yet settled. The symptoms may develop without jaundice, and cannot be attributed to cholæmia, and they may come on in hospital when the patient has not had alcohol for weeks.

The fatty cirrhotic liver may produce symptoms similar to those of the atrophic form, but it more frequently is latent and is found accidentally in topers who have died from various diseases. The greater number of the cases clinically diagnosed as cirrhosis with enlargement come in this division.

(*b*) *Hypertrophic* or biliary cirrhosis has a definite and distinctive symptomatology. The liver may be enlarged for months or even years. Jaundice persists for some time, on which point French writers lay great stress. It may, however, come on acutely with the other symptoms. It is intense, like an obstructive jaundice, but, as a rule, the stools are bile-stained. It may continue for a long time without the development of other symptoms; then delirium sets in and all the features of an acute febrile jaundice. The tongue is dry, the pulse rapid, the temperature ranges from 102° to 104°, and petechiæ occur on the skin. The patient may present every feature of acute yellow atrophy, including even the convulsive seizures. The attack in one of my cases proved fatal within ten days; in another it was prolonged for three weeks. Ascites does not develop. The enlargement of the liver may be the sole diagnostic criterion between these cases and acute yellow atrophy. I do not know, however, of the occurrence of leucin or tyrosin in the urine in this condition.

(*c*) The perihepatitis with cirrhosis cannot be distinguished from the ordinary atrophic form.

Diagnosis.—With ascites, a well-marked history of alcoholism, the hepatic facies, and hæmorrhage from the stomach or bowels, the diagnosis is rarely doubtful. If, after withdrawal of the fluid, the spleen is found to be enlarged and the liver either not palpable or, if it is enlarged, hard and regular, the probabilities in favor of cirrhosis are very great. In the early stages of the disease, when the liver is increased in size, it may be impossible to say whether it is a cirrhotic or a fatty liver. The differential diagnosis between common and syphilitic cirrhosis can sometimes be made. A marked history of syphilis or the existence of other syphilitic lesions, with great irregularity in the surface or at the edge of the liver, are the points in favor of the latter. Thrombosis or obliteration of the portal vein can rarely be differentiated In the case of fibroid transformation of the portal vein which came under my observation, the collateral circulation had been established for years, and the symptoms were simply those of extreme portal obstruction, such as occur in cirrhosis. Thrombosis of the portal vein is frequent in cirrhosis and may be characterized by a rapidly developing ascites.

Prognosis.—The prognosis is, as a rule, bad. When the collateral circulation is fully established the patient may have no symptoms what-

ever. Three cases of advanced atrophic cirrhosis have died under my observation of other affections without presenting during life any symptoms pointing to disease of the liver. There are instances, too, of enlargement of the liver, slight jaundice, cerebral symptoms, and even hæmatemesis, in which the liver becomes reduced in size, the symptoms disappear, and the patient may live in comparative comfort for many years. There are many cases, too, in which, after one or two tappings, the symptoms have disappeared and the patients have apparently recovered.

Treatment.—Ordinary cirrhosis of the liver is an incurable disease. Many writers, speaking of the curability of certain forms, show a lack of appreciation of the essential conditions upon which the symptoms depend. So far as we have any knowledge, no remedies at our disposal can alter or remove the cicatricial connective tissue which constitutes the *materia peccans* in ordinary cirrhosis. On the other hand, we know that extreme grades of contraction of the liver may persist for years without symptoms when the compensatory circulation exists. The so-called cure of cirrhosis means the re-establishment of this compensation; and it would be as unreasonable to speak of healing a chronic valvular lesion when with digitalis we have restored the circulatory balance as it is to speak of curing cirrhosis of the liver when by tapping and other measures the compensation has in some way been restored.

The patient should abstain entirely from alcohol, and, if possible, should take a milk diet, which has been highly recommended by Semmola. In any case, the diet should be nutritious, but not too rich. Measures should be employed to reduce the gastro-intestinal catarrh, and the patient should lead a quiet, out-of-door life and keep the skin active, the bowels regular, and the urine abundant. In non-syphilitic cases it is useless to give either mercury or iodide of potassium. When a well-marked history of syphilis exists these remedies should be used, but neither of them has any more influence upon the development of a new growth of connective tissue in the liver than it has upon the progressive development of a scar tissue in a keloid or in an ordinary developing cicatrix. The ascites should be tapped early, and the operation may be repeated so soon as the distention becomes distressing. The continuous drainage with a Southey's tube may be employed. It is much better to resort to tapping early if after a few days' trial the fluid does not subside rapidly under the use of saline purges. From half an ounce to an ounce and a half of sulphate of magnesia may be given in as little water as possible half an hour before breakfast. Elaterium, the compound jalap powder, or the bitartrate of potash may also be employed. Digitalis and squills are often useful. In the syphilitic cases or when syphilis is suspected iodide of potassium may be given in doses of from fifteen to thirty drops of the saturated solution three times a day, and mercury, which is conveniently given with squills and digitalis in the form of Addison's or Niemeyer's pill. A case of well-marked syphilitic cirrhosis with recurring ascites, in which tapping was resorted to on eight

or ten occasions, took this pill at intervals for a year with the greatest benefit, and subsequently had four years of tolerably good health.

V. ABSCESS OF THE LIVER.

Etiology.—Suppuration within the liver, either in the parenchyma or in the blood or bile passages, occurs under the following conditions:

(1) The tropical abscess. In hot climates this form may develop idiopathically, but more commonly follows dysentery. It frequently occurs among Europeans in India, particularly those who drink alcohol freely and are exposed to great heat. The relation of this form of abscess to dysentery is still under discussion, and Anglo-Indian practitioners are by no means unanimous on the subject. Certainly cases may develop without a history of previous dysentery, and there have been fatal cases without any affection of the large bowel. In this country the large solitary tropical abscess also occurs, oftenest in the Southern States. In Baltimore it is not very infrequent, as may be judged from the fact that during two years there have been at my clinic five cases, and I know of the occurrence of three or four additional cases during this time in the city.

The relation of this form of abscess to the *amœba coli* has been carefully studied by Kartulis and exhaustively considered in a monograph by Councilman and Lafleur. The descriptions and illustrations of these authors are most convincing as to the direct etiological association of this organism with liver abscess. Clinically the patient may have *amœba coli* in the stools and well-marked signs of liver abscess without marked symptoms of dysentery and even with the fæces well formed.

(2) Traumatism is an occasional cause. The injury is generally in the hepatic region. Two instances have come under my notice of it in brakemen who were injured while coupling cars. Injury of the head is not infrequently followed by liver abscess.

(3) Embolic or pyæmic abscesses are the most numerous, and may develop in a general pyæmia from any cause or follow foci of suppuration in the territory of the portal vessels. The infective agents may reach the liver through the hepatic artery, as in those cases in which the original focus of infection is in the area of the systemic circulation; though it may happen occasionally that the infective agent, instead of passing through the lungs, reaches the liver through the inferior vena cava and the hepatic veins. A remarkable instance of multiple abscesses of arterial origin was afforded by the case of aneurism of the hepatic artery reported by Ross and myself. Infection through the portal vein is much more common. It results from dysentery and other ulcerative affections of the bowels, appendicitis, occasionally after typhoid fever, in rectal affections, and in abscesses in the pelvis. In these cases the abscesses are multiple and, as a rule, within the branches of the portal vein—suppurative pylephlebitis.

(4) A not uncommon cause of suppuration is inflammation of the bile-passages caused by gall-stones, more rarely by parasites—suppurative cholangitis.

In some instances of tuberculosis of the liver the affection is chiefly of the bile-ducts, with the formation of multiple tuberculous abscesses containing a bile-stained pus.

(5) Foreign bodies and parasites. In rare instances foreign bodies, such as a needle, may pass from the stomach or gullet, lodge in the liver, and excite an abscess, or, as in several instances which have been reported, a foreign body, such as a needle or a fish-bone, may perforate a branch or the portal vein itself and induce extensive pylephlebitis. Echinococcus cysts frequently cause suppuration; the penetration of round worms into the liver less commonly; and most rarely of all the liver-fluke.

Morbid Anatomy.—(*a*) *Of the Solitary or Tropical Abscess.*—This is not always single; there may be two or even more large abscess cavities, ranging in size from an orange to a child's head. The largest-sized abscess may contain from three to six litres of pus and involve more than three fourths of the entire organ. In Waring's statistics, sixty-two per cent of the cases were single. The abscess in nearly seventy per cent of the cases was in the right lobe, more toward the convexity than the concave side. In long-standing cases the abscess-wall may be firm and thick, but, as a rule, the cavity possesses no definite limiting membrane, and section of the wall shows an internal layer, grayish in color, shreddy, and made up of necrotic liver substance, pus-cells, and amœbæ; a middle layer, brownish red in color; and an external zone of hyperæmic liver tissue. The pus is often reddish brown in color, closely resembling anchovy sauce. In other instances it is grayish white, mucoid, and may be quite creamy. The odor is at times very peculiar. In one instance it had the sour smell of chyme, though no connection with the stomach was found. In a recent case of amœbic dysentery there were multiple miliary abscesses in the liver, all of which contained amœbæ.

The bacteriological examination of the contents show that as a rule the pus is sterile (Kartulis). The termination of this form of abscess may be as follows, as noted in Waring's 300 cases: Remained intact, fifty-six per cent; opened by operation, sixteen per cent; perforated the right pleura, nearly five per cent; ruptured into the right lung, nine per cent; ruptured into the peritonæum, five per cent; ruptured into the colon, nearly three per cent; and there were in addition instances which ruptured into the hepatic and bile-vessels and into the gall-bladder.

(*b*) *Of Septic and Pyæmic Abscesses.*—These are always multiple, though occasionally, following injury, there may be a large solitary collection of pus.

In suppurative pylephlebitis the liver is uniformly enlarged. The capsule may be smooth and the external surface of the organ of normal appearance. In other instances, numerous yellowish-white points appear

beneath the capsule. On section there are isolated pockets of pus, either having a round outline or in some places distinctly dendritic, and from these the pus may be squeezed. They look like small, solitary abscesses, but, on probing, are found to communicate with the portal vein and to represent its branches, distended and suppurating. The entire portal system within the liver may be involved; sometimes territories are cut off by thrombi. The suppuration may extend into the main branch or even into the mesenteric and gastric veins. The pus may be fetid and is often bile-stained; it may, however, be thick, tenacious, and laudable. In suppurative cholangitis there is usually obstruction by gall-stones, the ducts are greatly distended, the gall-bladder enlarged and full of pus, and the branches within the liver are extremely distended, so that on section there is an appearance not unlike that described in pylephlebitis.

Suppuration about echinococcus cysts may be very extensive, forming enormous abscesses, the characters of which are at once recognized by the remnants of the cysts.

Symptoms.—(*a*) *Of the Large Solitary Abscess.*—In the tropics there are instances in which the abscess appears to be latent and to run a course without definite symptoms, and death may occur suddenly from rupture.

Fever, pain, enlargement of the liver, and the development of a septic condition are the important symptoms of hepatic abscess. The temperature is elevated at the outset and is of an intermittent or septic type. It is irregular, and may remain normal or even subnormal for a few days; then the patient has a rigor and the temperature rises to 103° or higher. Owing to this intermittent character of the fever the cases are usually, in this latitude, mistaken for malaria. The fever may rise every afternoon without a rigor. Profuse sweating is common, particularly when the patient falls asleep. In chronic cases there may be little or no fever. At the time of writing, there is in one of my wards a patient with liver abscess which has perforated the lung who still coughs up pus, but whose temperature has been normal for weeks. The pain is variable, and is usually referred to the back or shoulder; or there is a dull aching sensation in the right hypochondrium. When turned on the left side, the patient often complains of a heavy, dragging sensation, so that he usually prefers to lie on the right side; at least, this has been the case in a majority of the instances which have come under my observation. Pain on pressure over the liver is usually present, particularly deep pressure at the costal margin in the nipple line.

The enlargement of the liver is most marked in the right lobe, and, as the abscess cavity is usually situated more toward the upper than the under surface, the increase in volume is upward and to the right, not downward, as in cancer and the other affections producing enlargement. Percussion in the mid-sternal and parasternal lines may show a normal limit. At the nipple-line the curve of liver dulness begins to rise, and in the mid-

axillary it may reach the fifth rib, while behind, near the spine, the area of dulness may be almost on a level with the angle of the scapula. Of course there are instances in which this characteristic feature is not present, as when the abscess occupies the left lobe. The enlargement of the liver may be so great as to cause bulging of the right side, and the edge may project a hand's-breadth or more below the costal margin. In such instances the surface is smooth. Palpation is painful, and there may be fremitus on deep inspiration. In some instances fluctuation may be detected. Adhesions may form to the abdominal wall and the abscess may point below the margin of the ribs, or even in the epigastric region. In many cases the appearance of the patient is suggestive. The skin has a sallow, slightly icteroid tint, the face is pale, the complexion muddy, the conjunctivæ are infiltrated, and often slightly bile-tinged. There is in the facies and in the general appearance of the patient a strong suggestion of the existence of abscess. There is no internal affection associated with suppuration which gives, I think, just the same hue as certain instances of abscess of the liver. Marked jaundice is rare. Diarrhœa may be present and may give an important clew to the nature of the case, particularly if amœbæ are found in the stools. Constipation may occur.

Remarkable and characteristic symptoms arise when the abscess invades the lung. The extension may occur through the diaphragm, without actual rupture, and with the production of a purulent pleurisy and invasion of the lung. In four cases of this kind, which have been under observation recently, the patients gradually developed a severe cough, usually of an aggravated and convulsive character, there were signs of involvement at the base of the right lung, defective resonance, feeble tubular breathing, and increase in the tactile fremitus; but the most characteristic feature was the presence of a reddish-brown expectoration of a brick-dust color, resembling anchovy sauce. This, which was noted originally by Budd, was present in our cases, and in addition Reese and Lafleur found in all *amœbæ coli* identical with those which exist in the liver abscess and in the stools. They are present in variable numbers and display active amœbic movements. The brownish tint of the expectoration is due to blood-pigment and blood-corpuscles, and there may be orange-red crystals of hæmatoidin.

The abscess may perforate externally, as mentioned already, or into the stomach or bowel; occasionally into the pericardium. The duration of this form is very variable. It may run its course and prove fatal in six or eight weeks or may persist for several years.

The prognosis is serious, as the mortality is more than fifty per cent. The death-rate has been lowered of late years, owing to the greater fearlessness with which surgeons now attack these cases.

(*b*) *Of the Pyæmic Abscess and Suppurative Pylephlebitis.*—Clinically these conditions cannot be separated. Occurring in a general pyæmia, no special features may be added to the case. When there is suppuration

within the portal vein the liver is uniformly enlarged and tender, though pain may not be a marked feature. There is an irregular, septic fever, and the complexion is muddy, sometimes distinctly icteroid. The features are indeed those of pyæmia, plus a slight icteroid tinge, and an enlarged and painful liver. The latter features alone are peculiar. The sweats, chills, prostration, and fever have nothing distinctive.

Diagnosis.—Abscess of the liver may be confounded with intermittent fever, a common mistake in malarial regions. Practically an intermittent fever which resists quinine is not malarial. Laveran's organisms are also absent from the blood. When the abscess bursts into the pleura a right-sided empyema is produced and perforation of the lung usually follows. When the liver abscess has been latent and dysenteric symptoms not marked, the condition may be considered empyema or abscess of the lung. In such cases the anchovy-sauce-like color of the pus and the presence of the amœbæ will enable one to make a definite diagnosis, as has been done in cases by Lafleur. Perforation externally is readily recognized, and yet in an abscess cavity in the epigastric region it may be difficult to say whether it has proceeded from the liver or is in the abdominal wall. When the abscess is large, and the adhesions are so firm that the liver does not descend during inspiration, the exploratory needle does not make an up-and-down movement during aspiration. In an instance of this kind which I saw with Hearn at the Philadelphia Hospital, all the features, local and general, seemed to point to abscess in the abdominal wall, but the operation revealed a large perforating abscess cavity in the left lobe of the liver. The diagnosis of suppurating echinococcus cyst is rarely possible, except in Australia and Iceland, where hydatids are so common. In the only case which has come under my observation, the innumerable tumors scattered throughout the abdomen and the great size of the liver led, not unnaturally, in spite of the occurrence of septic symptoms, to the diagnosis of cancer.

Perhaps the most important affection from which suppuration within the liver is to be separated is the intermittent hepatic fever associated with gall-stones. Of the cases reported a majority have been considered due to suppuration, and in two of my cases the liver had been repeatedly aspirated. Post-mortem examinations have shown conclusively that the high fever and chills may recur at intervals for years without suppuration in the ducts. The distinctive features of this condition are paroxysms of fever with rigors and sweats—which may occur with great regularity, but which more often are separated by long intervals—the deepening of the jaundice after the paroxysms, the entire apyrexia in the intervals, and the maintenance of the general nutrition. The time element also is important, as in some of these cases the disease has lasted for several years. Finally, it is to be remembered that abscess of the liver, in temperate climates at least, is invariably secondary, and the primary source must be carefully sought for, either in dysentery, slight ulceration of the rectum, suppurating

Sreeves reports a case in which he performed laparotomy for supposed abscess of the liver following appendicitis. The organ was enlarged and soft and dotted with minute yellow specks. The region of the portal vein was examined but nothing peculiar noted. The patient recovered. (Lancet - 1894 - No. 11). It is not unreasonable to question the correctness of the diagnosis of pylephlebitis in this case.

hæmorrhoids, ulcer of the stomach, or in suppurative diseases of other parts of the body, particularly in the skull or in the bones.

In suspected cases, whether the liver is enlarged or not, exploratory aspiration may be performed without risk. The needle may be entered in the anterior axillary line in the lowest interspace, or in the seventh interspace in the mid-axillary line, or over the centre of the area of dulness behind. The patient should be placed under ether, for it may be necessary to make several deep punctures. It is not well to use too small an aspirator. No ill effects follow this procedure, even though blood may leak into the peritoneal cavity. Extensive suppuration may exist, and yet be missed in the aspiration, particularly when the branches of the portal vein are distended with pus.

Treatment.—Pyæmic abscesses and suppurative pylephlebitis are invariably fatal. Surgical measures are not justified in these cases, unless an abscess shows signs of pointing As the abscesses associated with dysentery are often single, they afford a reasonable hope for operation. If, however, the patient is expectorating the pus, if the general condition is good and the hectic fever not marked, it is best to defer operation, as many of these instances recover spontaneously. The large single abscesses offer the best chance for operation.

The general medical treatment of the cases is that of ordinary septicæmia.*

VI. NEW GROWTHS IN THE LIVER.

These may be cancer, either primary or secondary, sarcoma, or angioma.

Etiology.—Cancer of the liver is third in order of frequency of internal cancer. It is rarely primary, usually secondary to cancer in other organs. It is a disease of late adult life. According to Leichtenstern, over fifty per cent of the cases occur between the fortieth and the sixtieth years. It occasionally occurs in children. Women are attacked less frequently than men. It is stated by some authors that secondary cancer is more common in women, owing to the frequency of cancer of the uterus. Heredity is believed to have an influence in from fifteen to twenty per cent.

In many cases trauma is an antecedent, and cancer of the bile-passages is associated in many cases with gall-stones. Cancer is stated to be less common in the tropics. Its relative proportion to other diseases may be judged from the fact that among the first three thousand patients admitted to the wards of the Johns Hopkins Hospital there were seven cases of cancer of the liver.

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* For general rules and the modern surgical treatment of the condition, the reader is referred to Godlee's lectures, British Medical Journal, vol. i, 1890.

Morbid Anatomy.—The following forms of new growths occur in the liver and have a clinical importance:

Cancer.—(1) *Primary cancer*, of which three forms may be recognized.*

(*a*) The *massive cancer*, which causes great enlargement and on section shows a uniform mass of new growth, which occupies a large portion of the organ. It is grayish white, usually not softened, and is abruptly outlined from the contiguous liver substance.

(*b*) *Nodular cancer*, in which the liver is occupied by nodular masses, some large, some small, irregularly scattered throughout the organ. Usually in one region there is a larger, perhaps firmer, older-looking mass, which indicates the primary seat, and the numerous nodules are secondary to it. This form is much like the secondary cancerous involvement, except that it seldom reaches a large size.

(*c*) The third is the remarkable and rare variety, *cancer with cirrhosis*, which forms an anatomical picture perfectly unique and at first very puzzling. The liver is not much enlarged, rarely weighing more than two and a half or three kilogrammes. The surface is grayish yellow, studded over with nodular yellowish masses, resembling the projections in an ordinary cirrhotic liver. On section the cancerous nodules are seen scattered throughout the entire organ, varying in diameter from three to ten or more millimetres and surrounded with fibrous tissue.

Histologically, the primary cancers are epitheliomata—alveolar and trabecular. The character of the cells varies greatly. Some varieties are polymorphous; others small polyhedral; and others again contain giant cells. In rare instances, as in one described by Greenfield, the cells are cylindrical. The trabecular form of epithelioma is also known as adenoma or adeno-carcinoma.

(2) *Secondary Cancer.*—The organ is usually enormously enlarged, and may weigh twenty pounds or more. The cancerous nodules project beneath the capsule, and can be felt during life or even seen through the thin abdominal walls. They are usually disseminated equally, though in rare instances they may be confined to one lobe. The consistence of the nodules varies; in some cases they are firm and hard and those on the surface show a distinct umbilication, due to the shrinking of the fibrous tissue in the centre. These superficial cancerous masses are still sometimes spoken of as "Farre's tubercles." More frequently the masses are on section grayish white in color, or hæmorrhagic. Rupture of blood-vessels is not uncommon in these cases. In one specimen there was an enormous clot beneath the capsule of the liver, together with hæmorrhage into the gall-bladder and into the peritonæum. The secondary cancer shows the same structure as the initial lesion, and is usually either an alveolar or cylindrical carcinoma. Degeneration is common in these second-

* Hanot and Gilbert, Études sur les Maladies du Foie, Paris, 1888.

ary growths; thus the hyaline transformation may convert large areas into a dense, dry, grayish-yellow mass. Extensive areas of fatty degeneration may occur, sclerosis is not uncommon, and hæmorrhages are frequent. Suppuration sometimes follows.

(3) *Cancer of the Bile-Passages.*—Much attention has been given to this of late, and both Zenker and Musser have recently published exhaustive papers on the subject. In 100 cases collected by Musser the large proportion (3 to 1) were in females. Jaundice was present in sixty-nine per cent, and in about the same percentage there was a tumor in the region of the gall-bladder. Courvoisier has collected 100 cases, of which 83 were in men and 17 in women. The association of cancer of the bile-passages with calculi has long been recognized, and they are present in at least seven eighths of all cases. The fundus of the gall-bladder is usually involved first. The process may extend to the common or hepatic ducts, and invasion of the contiguous structures is common. The ducts may be affected primarily.

Sarcoma.—Of primary sarcoma of the liver very few cases have been reported. Secondary sarcoma is more frequent, and many examples of lympho-sarcoma and myxo-sarcoma are on record, less frequently glio-sarcoma or the smooth or striped myoma.

The most important form is the melano-sarcoma, which develops in the liver secondarily to sarcoma of the eye or of the skin. Very rarely melano-sarcoma develops primarily in the liver. Of the reported cases Hanot excludes all but one. In this form the liver is greatly enlarged, is either uniformly infiltrated with the cancer, which gives the cut surface the appearance of dark granite, or there are large nodular masses of a deep black or marbled color. There are usually extensive metastases, and in some instances every organ of the body is involved. Nodules of melano-sarcoma of the skin may give a clew to the diagnosis.

Other Forms of Liver Tumor.—One of the commonest tumors in the liver is the angioma, which occurs as a small, reddish body the size of a walnut, and consists simply of a series of dilated vessels. Occasionally in children angiomata have developed and produced large tumors.

Cysts are occasionally found in the liver, either single, which are not very uncommon, or multiple, when they usually coexist with congenital cystic kidneys.

Symptoms.—It is often impossible to differentiate primary and secondary cancer of the liver unless the primary seat of the disease is evident, as in the case of scirrhus of the breast, or cancer of the rectum, or of a tumor in the stomach, which can be felt. As a rule, cancer of the liver is associated with progressive enlargement; but there are cases of primary nodular cancer, and in the cancer with cirrhosis the organ may not be enlarged. Gastric disturbance, loss of appetite, nausea, and vomiting are frequent. Progressive loss of flesh and strength may be the first symptoms. Pain or a sensation of uneasiness in the right hypochondriac region

may be present, but enormous enlargement of the liver may occur without the slightest pain. Jaundice, which is present in at least one half of the cases, is usually of moderate extent, unless the common duct is occluded. Ascites is rare, except in the form of cancer with cirrhosis, in which the clinical picture is that of the atrophic form. Pressure by nodules on the portal vein or extension of the cancer to the peritonæum may also induce ascites.

Inspection shows the abdomen to be distended, particularly in the upper zone. In late stages of the disease, when emaciation is marked, the cancerous nodules can be plainly seen beneath the skin, and in rare instances even the umbilications. The superficial veins are enlarged. On palpation the liver is felt, a hand's-breadth or more below the costal margin, descending with each inspiration. The surface is usually irregular, and may present large masses or smaller nodular bodies, either rounded or with central depressions. In instances of diffuse infiltration the liver may be greatly enlarged and present a perfectly smooth surface. The growth is progressive, and the edge of the liver may ultimately extend below the level of the navel. Although generally uniform and producing enlargement of the whole organ, occasionally, when the tumor develops from the left lobe, it may form a solid mass, which occupies the epigastric region. By percussion the outline can be accurately limited and the progressive growth of tumor estimated. The spleen is rarely enlarged. Pyrexia is present in many cases, usually a continuous fever, ranging from 100° to 102°; it may be intermittent with rigors. This may be associated with the cancer alone, or, as in one of my cases, with suppuration. Œdema of the feet, from anæmia, usually supervenes. Cancer of the liver kills in from three to fifteen months.

Diagnosis.—The diagnosis is easy when the liver is greatly enlarged and the surface nodular. The smoother forms of diffuse carcinoma may at first be mistaken for fatty or amyloid liver, but the presence of jaundice, the rapid enlargement, and the more marked cachexia will usually suffice to differentiate it. Perhaps the most puzzling conditions occur in the rare cases of enlarged amyloid liver with irregular gummata. The large echinococcus liver may present a striking similarity to carcinoma, but the projecting nodules are usually softer, the disease lasts much longer, and the cachexia is not marked.

Hypertrophic cirrhosis may at first be mistaken for carcinoma, as the jaundice is usually deep and the liver very large; but the absence of a marked cachexia and wasting, and the painless, smooth character of the enlargement are points against cancer. When in doubt in these cases, aspiration may be safely performed, and positive indication may be gained from the materials so obtained. In large, rapidly growing secondary cancers the superficial rounded masses may almost fluctuate and these soft tumor-like projections may contain blood. The form of cancer with cirrhosis can scarcely be separated from atrophic cirrhosis itself. Perhaps

the wasting is more extreme and more rapid, but the jaundice and the ascites are identical. Melano-sarcoma causes great enlargement of the organ. There are frequently symptoms of involvement of other viscera, as the lungs, kidneys, or spleen. Secondary tumors may develop on the skin. A very important symptom, not present in all cases, is melanuria, the passage of a very dark-colored urine, which may, however, when first voided, be quite normal in color. The existence of a melano-sarcoma of the eye, or the history of blindness in one eye, with subsequent extirpation, may indicate at once the true nature of the hepatic enlargement. The secondary tumors may develop some time after the extirpation of the eye, as in a case under the care of J. C. Wilson, at the Philadelphia Hospital, or, as in a case under Tyson at the same institution, the patient may have a sarcoma of the choroid which had never caused any symptoms. Primary cancer of the gall-bladder can rarely be diagnosed. It may be greatly dilated and readily palpable. Occasionally tumors of the kidney or a tumor of the transverse colon may be confounded with it.

The *treatment* must be entirely symptomatic—allaying the pain, relieving the gastric disturbance, and meeting other symptoms as they arise.

VII. FATTY LIVER.

Two different forms of this condition are recognized—the fatty infiltration and fatty degeneration.

Fatty infiltration occurs, to a certain extent, in normal livers, since the cells always contain minute globules of oil.

In fatty degeneration, which is a much less common condition, the protoplasm of the liver-cells is destroyed and the fat takes its place, as seen in cases of malignant jaundice and in phosphorus poisoning.

Fatty liver occurs under the following conditions: (*a*) In association with general obesity, in which case the liver appears to be one of the store-houses of the excessive fat. (*b*) In conditions in which the oxidation processes are interfered with, as in cachexia, profound anæmia, and in phthisis. The fatty infiltration of the liver in heavy drinkers is to be attributed to the excessive demand made by the alcohol upon the oxygen. (*c*) Certain poisons, of which phosphorus is the most characteristic, produce an intense fatty degeneration with necrosis of the liver-cells. The poison of acute yellow atrophy, whatever its nature, acts in the same way.

The fatty liver is uniformly increased in size. The edge may reach below the level of the navel. It is smooth, looks pale and bloodless; on section it is dry, and renders the surface of the knife greasy. The organ may weigh many pounds, and yet the specific gravity is so low that the entire organ floats in water.

The symptoms of fatty liver are not definite. Jaundice is never present; the stools may be light-colored, but even in the most advanced grades

the bile is still formed. Signs of portal obstruction are rare. Hæmorrhoids are not very infrequent. Altogether, the symptoms are ill-defined, and chiefly those of the disease with which the degeneration is associated. In cases of great obesity, the physical examination is uncertain; but in phthisis and cachectic conditions, the organ can be felt, greatly enlarged, smooth, and painless. Fatty livers are among the largest met with at the bedside.

VIII. AMYLOID LIVER.

The waxy, lardaceous, or amyloid liver occurs as part of a general degeneration, associated with cachexias, particularly when the result of long-standing suppuration.

In practice, it is found oftenest in the prolonged suppuration of tuberculous disease, either of the lungs or of the bones. Next in order of frequency are the cases associated with syphilis. Here there may be ulceration of the rectum, with which it is often connected, or chronic disease of the bone, or it may be present when there are no suppurative changes. It is found occasionally in rickets, in prolonged convalescence from the infectious fevers, and in the cachexia of cancer.

The amyloid organ is large, and may attain dimensions equalled only by that of the cancerous organ. Wilks speaks of a liver weighing fourteen pounds. It is solid, firm, resistant, on section anæmic, and has a semitranslucent, infiltrated appearance. Stained with a dilute solution of iodine, the areas infiltrated with the amyloid matter assume a rich mahogany-brown color. The precise nature of this change is still in question. It first attacks the capillaries, usually of the median zone of the lobules, and subsequently the interlobular vessels and the connective tissue. The cells are but little if at all affected.

There are no characteristic *symptoms* of this condition. Jaundice does not occur; the stools may be light-colored, but the secretion of bile persists. The physical examination shows the organ to be uniformly enlarged and painless, the surface smooth, the edges rounded, and the consistence greatly increased. Sometimes the edge, even in very great enlargement, is sharp and hard. The spleen also may be involved, but there are no evidences of portal obstruction.

The *diagnosis* of the condition is, as a rule, easy. Progressive and great enlargement in connection with suppuration of long standing or with syphilis, is almost always of this nature. In rare instances, however, the amyloid liver is reduced in size.

In *leukæmia* the liver may attain considerable size and be smooth and uniform, resembling, on physical examination, the fatty organ. The blood condition at once indicates the true nature of the case.

IX. DISEASES OF THE PANCREAS.

I. HÆMORRHAGE.

It is very important that normal conditions of the organ be not overlooked be mistaken. It is often hard with the lobes very distinct; atrophy is common in wasting diseases & in old age. Microscopically the fat drops changes of self digestion must not be regarded as coagulation necrosis, and lastly in all cases of pancreatic disease the relations of the organ to the lesser peritoneum must constantly be borne carefully in mind.

W. Osler
Presbyn

IX. DISEASES OF THE PANCREAS.

I. HÆMORRHAGE.

Of late years much attention has been paid to this condition, which may prove rapidly fatal and has important medico-legal bearings. F. W. Draper * has reported five cases, in all of which death occurred either suddenly or after a very short illness. The symptoms are thus briefly summarized by Prince:

"The patient, who has previously been perfectly well, is suddenly taken with the illness which terminates his life. . . . When the hæmorrhage occurs the patient may be quietly resting or pursuing his usual occupation. The pain which ushers in the attack is usually very severe, and located in the upper part of the abdomen. It steadily increases in severity, is sharp or perhaps colicky in character. It is almost from the first accompanied by nausea and vomiting; the latter becomes frequent and obstinate, but gives no relief. The patient soon becomes anxious, restless, and depressed; he tosses about, and only with difficulty can be restrained in bed. The surface is cold, and the forehead is covered with a cold sweat. The pulse is weak, rapid, and sooner or later imperceptible. The abdomen becomes tender, the tenderness being located in the upper part of the abdomen or epigastrium. Tympanites is sometimes marked. The temperature in most cases is either normal or below normal. The bowels are apt to be constipated. These symptoms continue without relief; those which are most striking being the pain, vomiting, anxiousness, restlessness, and the state of collapse into which the patient soon falls."

Post mortem, the pancreas is found uniformly infiltrated with blood. Death, as Zenker suggests, is probably due to shock through the solar plexus.

There are cases in which extensive hæmorrhage occurs into the mesentery, retroperitonæum, or mesocolon. In a patient of Bruen's, at the Philadelphia Hospital, who had for some days obscure abdominal symptoms, I found the entire mesentery and retroperitonæum infiltrated with blood-clots. There was no disease of the aorta or of the cœliac branches or of the mesenteric vessels. Isambard Owen has reported a case of sudden death in a woman aged sixty-seven from hæmorrhage into the transverse mesocolon.

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* Transactions of the Association of American Physicians, vol. i.

II. ACUTE PANCREATITIS.

(*a*) **Acute Hæmorrhagic Pancreatitis.**—The admirable studies of Fitz* have crystallized our knowledge on this subject, and brought the affection within the scope of the diagnostician. A majority of the cases occur in persons over thirty. Many of the patients had been addicted to alcohol, and many had suffered from attacks of indigestion, occasionally with severe pains and vomiting.

Morbid Anatomy.—The pancreas is found enlarged, and the interlobular tissue infiltrated with blood, and perhaps with clots. In some instances the contiguous tissues may also be hæmorrhagic, and the whole may form a large, firm mass, situated at the upper and back part of the abdominal cavity. The root of the mesentery, the mesocolon, and the omentum may also show hæmorrhages; the other organs may be practically normal. In some instances there can be seen about the lobules areas of opaque white tissue, and upon the omentum and mesentery similar opaque, white specks, which will be referred to subsequently as the fatty necrosis of Balser. In spots the gland-cells may also be found necrotic, while there may be cases showing a marked increase in the fibrous tissue.

The *symptoms* of this condition are remarkable. The attack sets in with violent pain in the abdomen, usually in the upper zone, but in some instances it is general. Nausea and vomiting are present, and usually constipation. Tympanitic distention of the abdomen is of frequent occurrence. Fever may be present, but is an inconstant symptom. There may be early delirium. Collapse symptoms supervene, and death occurs usually from the second to the fourth day, or even earlier. The swelling and infiltration in the region of the pancreas necessarily involve the cœliac plexus, and the stretching of the nerves may account for the agonizing pain and the sudden collapse. In a case which I have reported the semilunar ganglia were swollen, the nerve-cells indistinct, and there was an interstitial infiltration of round cells. The Pacinian corpuscles in the neighborhood of the pancreas were enormously swollen and œdematous.

A *diagnosis* of intestinal obstruction or of acute perforative peritonitis is usually made. A correct diagnosis was made in one case by Fitz, and the possibility of the presence of this condition must be considered in all abdominal cases which come on suddenly with intense pain in the epigastric region, vomiting, and distention of the abdomen. Perforation of a peptic ulcer or perforation from gall-stones might produce similar symptoms, but the previous history would give important indications. In the case in which the diagnosis was made by Fitz, the patient was suddenly seized with severe pain in the epigastrium, followed by vomiting and prostration. The abdomen was distended, temperature slightly elevated, and the bowels were constipated. The diagnosis lay between ob-

* Middleton-Goldsmith Lecture. New York Medical Record, vol. i, 1889.

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(a) Acute Hæmorrhagic Pancreatitis.—The admirable studies of Fitz* have greatly clarified our knowledge on this subject, and brought the affection within the scope of the diagnostician. A majority of the cases occur in persons over thirty. Many of the patients had been addicted to alcohol, and many had suffered from attacks of indigestion, occasionally with severe pain and vomiting.

Morbid Anatomy.—The pancreas is found enlarged, and the interlobular tissue infiltrated with blood, and perhaps with clots. In some instances the contiguous tissues may also be hæmorrhagic, and the whole may form a large, firm mass, situated at the upper and back part of the abdominal cavity. The root of the mesentery, the mesocolon, and the omentum may also show hæmorrhages; the other organs may be practically normal. In some instances there can be seen about the lobules areas of opaque white tissue, and upon the omentum and mesentery similar opaque white specks, which will be referred to subsequently as the fatty necrosis of Balser. In spots the gland-cells may also be found necrotic, while there may be cases showing a marked increase in the fibrous tissue.

The *symptoms* of this condition are remarkable. The attack sets in with violent pain in the abdomen, usually in the upper zone, but in some instances it is general. Nausea and vomiting are present, and usually constipation. Tympanitic distention of the abdomen is of frequent occurrence. Fever may be present, but is an inconstant symptom. There may be early delirium. Collapse symptoms supervene, and death occurs usually from the second to the fourth day, or even earlier. The swelling and infiltration in the region of the pancreas necessarily involve the coeliac plexus, and the stretching of the nerves may account for the agonizing pain and the sudden collapse. In a case which I have reported the semilunar ganglia were swollen, the nerve-cells indistinct, and there was an interstitial infiltration of round cells. The Pacinian corpuscles in the neighborhood of the pancreas were enormously swollen and œdematous.

A *diagnosis* of intestinal obstruction or of acute perforative peritonitis is usually made. A correct diagnosis was made in one case by Fitz, and the possibility of the presence of this condition must be considered in all abdominal cases which come on suddenly with intense pain in the epigastric region, vomiting, and distention of the abdomen. Perforation of a peptic ulcer or perforation from gall-stones might produce similar symptoms, but the previous history would give important indications. In the case in which the diagnosis was made by Fitz, the patient was suddenly seized with severe pain in the epigastrium, followed by vomiting and prostration. The abdomen was distended, temperature slightly elevated, and the bowels were constipated. The diagnosis lay between ob-

* Boylston Prize Essay, 1882. New York Medical Record, vol. i, 1882.

struction, perforative peritonitis, and acute pancreatitis. Laparotomy was performed, but no obstruction found. The autopsy showed acute hæmorrhagic pancreatitis.

The cases are stated to be uniformly fatal, but recovery may occur, as shown by a case which was admitted to the Johns Hopkins Hospital. Symptoms of obstruction of the bowels had persisted for three or four days, the abdomen was distended, tender, and very painful. I saw the patient on admission, concurred in the diagnosis of probable obstruction, and, as the condition was serious, ordered him to be transferred at once to the operating-room. The coils were distended and injected, and the peritoneal cavity contained a small amount of bloody serum. No obstruction was found, but in the region of the pancreas and at the root of the mesentery there was a dense, thick, indurated mass and there were areas of fat-necrosis in both mesentery and omentum. The patient recovered.

The literature of the past few years shows that this affection is much more frequent than has been supposed. It has a very important clinical and medico-legal bearing.

A point of interest is the relation of the *fat-necrosis* to pancreatic disease. The areas are found in the interlobular pancreatic tissue, in the mesentery, in the omentum, and in the abdominal fatty tissue generally. In the pancreas the lobules are seen to be separated by a dead-white necrotic tissue, which gives a remarkable appearance to the section. In the abdominal fat the areas are usually not larger than a pin's head; they at once attract attention, and may be mistaken, on superficial examination, for miliary tubercles or neoplasms. They may be larger; instances have been reported in which they were the size of a hen's egg. On section they have a soft, tallowy consistence. Langerhans has shown that this substance is a combination of lime with certain fatty acids. They may be crusted with lime, and in a man, aged eighty, who died of Bright's disease, I found the lobules of the pancreas entirely isolated by areas of fatty necrosis with extensive deposition of lime salts. There is no necessary etiological relation between disease of the pancreas and disseminated fatty necrosis of the abdomen. Cases have been found accidentally in laparotomy for ovarian tumor and in instances in which the pancreas has been normal. They may be found in thin persons. The *bacterium coli commune* was present in two cases, with diphtheritic colitis, examined by Welch.

(*b*) **Suppurative Pancreatitis.**—Of twenty-two cases analyzed by Fitz, the majority occurred in adults under forty years of age; seventeen were males. Anatomically, there may be a diffuse suppuration throughout the organ, which is studded with small abscesses. In other instances the abscess cavity is large and the pancreas is converted into an irregular cyst filled with creamy pus. In more chronic cases the abscess may be circumscribed and the contents cheesy. Communications sometimes occur with the duodenum, or the abscess may burst into the peritonæum. Although the disease is usually chronic, it begins with epigastric pain,

vomiting, and sometimes prostration. There is irregular fever, and death may occur in three or four weeks. In more chronic cases there is very slight fever or only occasional paroxysms. The disease may persist for weeks, months, or even for a year.

The symptoms are indefinite and the condition could scarcely be made out during life. Tenderness exists in the epigastrium, or may at times extend to the left and be quite sharply localized over the position of the pancreas, but a circumscribed tumor is rare. Fat-necrosis is not often found post mortem in these cases.

(*c*) **Gangrenous Pancreatitis.**—Fitz has collected fifteen cases. The pancreas may be converted into a dark, slate-colored, stinking mass, or it may lie nearly free in the omental cavity, attached only by a few shreds of fibrous tissue. Complete sequestration of the organ is not uncommon. It may be discharged as a slough from the bowels, and in two cases in which this happened recovery took place. As a rule, acute peritonitis follows. Hæmorrhagic pancreatitis may precede or be associated with it. Death occurs with symptoms of collapse, commonly in from ten to twenty days. Disseminated fat-necrosis is usually present.

III. CHRONIC PANCREATITIS.

The organ is firmer than normal, the interstitial connective tissue is increased, and there is more or less change in the secreting structures. A special interest has been aroused lately in this affection, as it has been frequently found in diabetes. There may be marked pigmentary changes; a similar condition has been found in the liver. Degeneration of the glandular elements is present in these cases. The sclerosis may be associated with calculi in the ducts.

IV. PANCREATIC CYSTS.

These commonly result from the impaction of calculi; either biliary, lodging at the orifice of the common duct, or pancreatic, within the duct of Wirsung. The pancreatic concretions consist usually of carbonate of lime. W. W. Johnston has collected 35 cases from the literature. Obliteration of the duct may also result from cicatricial contraction and occasionally from displacement. Eighteen cases of cysts of the pancreas have been collected by Senn. The chief symptoms are tumor in the epigastric region, usually median, or sometimes to one side. When large it has occupied the whole abdominal cavity, and in such instances the diagnosis of ovarian tumor has usually been made. The tumor may develop rapidly, or may be chronic and last for many years. In some instances the tumor attained a large size within a few weeks. Pain is not neces-

Thayer's case. Recovery after operation by Finney.

and smaller

an interstitial hyperplasia may cause great wasting of the glandular tissue

sarily present. Fatty diarrhœa did not exist in any of the cases. The stools may be clay-colored, copious, and putrescent.

The diagnosis of the condition must be extremely difficult, yet it seems to have been made in 7 of the 18 cases. Aspiration should be made to determine the nature of the fluid. This has varied considerably, but most frequently has been brownish or chocolate-colored. In only 6 of the 17 cases in which the nature is mentioned was the fluid of a clear serous character.

V. CANCER.

This is usually scirrhus, and may be primary or secondary. It is not common, as may be judged by the analysis by Segre, who found in 11,492 autopsies only 132 tumors of the pancreas, 127 of which were carcinomata, 2 sarcomata, 2 cysts, and 1 syphiloma. In only 12 of the cases of carcinoma was the disease limited to the gland. The head is commonly affected, and the disease may be limited to this part or extend to it from the stomach or intestines.

The symptoms are variable, and a diagnosis is not often possible. There may be stearrhœa, though it is to be remembered that fatty diarrhœa is not invariably associated with disease of the pancreas. Clay-colored, greasy, and loose stools may be present, with undigested food, as noted by T. J. Walker as a symptom of obstruction of the pancreatic duct. Diabetes may coexist. Although the head of the pancreas can be felt in very thin persons, the tumor masses can rarely be palpated. In the analysis of 137 cases by Da Costa, in only 13 was the tumor recognized by palpation. The general symptoms are those of internal carcinoma. Progressive emaciation, loss of strength, and dyspepsia are present. There is pain in the epigastrium, sometimes paroxysmal. When the head of the pancreas is involved jaundice is almost invariably present.

The disease can scarcely ever be distinguished from cancer in the pyloric zone with involvement of the glands in the hilus of the liver. The movable character of the pyloric tumor and the absence of the hydrochloric acid in the vomit are valuable points. Tumor of the transverse colon is more superficial and movable, is often associated with temporary obstruction, and there may be hæmorrhage from the bowels. In a case with progressive emaciation, epigastric pain, and deep-seated, immobile tumor, with the presence of fatty and greasy stools and the gradual development of jaundice, the diagnosis of cancer of the pancreas is probable.

As the wasting proceeds the aortic pulsation is transmitted with great force through the pancreas and transverse colon, and when a tumor is present the diagnosis of aneurism may be made; but in the latter the sac has not an up-and-down jerking pulsation, but is distensile. In doubtful tumors in this region the examination should also be made in the knee-elbow position.

Of other new growths in the pancreas, tubercle may be mentioned as a rare occurrence; a few cases of syphiloma have been described.

The treatment of new growths in the pancreas is entirely symptomatic.

X. DISEASES OF THE PERITONÆUM.

I. ACUTE GENERAL PERITONITIS.

Definition.—Acute inflammation of the peritonæum.

Etiology.—The condition may be primary or secondary.

(*a*) **Primary, Idiopathic Peritonitis.**—Considering how frequently the pleura and pericardium are primarily inflamed the rarity of idiopathic inflammation of the peritonæum is somewhat remarkable. It may follow cold or exposure and is then known as rheumatic peritonitis. No instance of the kind has come under my notice. Occasionally in Bright's disease acute peritonitis develops as a terminal event.

(*b*) **Secondary Peritonitis** is due to extension of inflammation from, or perforation of one of the organs covered by the peritonæum. Peritonitis from extension may follow inflammation of the stomach or intestines, extensive ulceration in these parts, cancer, acute suppurative inflammations of the spleen, liver, pancreas, retroperitoneal tissues, and the pelvic viscera.

Perforative peritonitis is the most common, following external wounds, perforation of ulcer of the stomach or bowels, perforation of the gall-bladder, abscess of the liver, spleen, or kidneys. Two important causes are appendicitis and suppurating inflammation about the Fallopian tubes and ovaries. There are instances in which peritonitis has followed rupture of an apparently normal Graafian follicle.

The peritonitis of septicæmia and pyæmia is almost invariably the result of a local process. An exceedingly acute form of peritonitis may be caused by the development of tubercles on the membrane.

Morbid Anatomy.—In recent cases, on opening the abdomen the intestinal coils are distended and glued together by lymph, and the peritonæum presents a patchy, sometimes a uniform injection. The exudation may be: (*a*) Fibrinous, with little or no fluid, except a few pockets of clear serum between the coils. (*b*) Sero-fibrinous. The coils are covered with lymph, and there is in addition a large amount of a yellowish, sero-fibrinous fluid. In instances in which the stomach or intestine is perforated this may be mixed with food or fæces. (*c*) Purulent, in which the exudate is either thin and greenish yellow in color, or opaque white and creamy. (*d*) Putrid. Occasionally in puerperal and perforative peritonitis, particularly when the latter has been caused by cancer, the exudate is thin, grayish green in color, and has a gangrenous odor. (*e*) Hæmorrhagic. This is sometimes found as an admixture in cases of acute peri-

VII Pancreatic calculi

Possibly obscure cases of colic may depend upon these presence and Wurmuch (Berliner Klin Wochen. 1883) & Mich Jr. March 31st 1894.) has reported a case in which after the attack of colic calculi composed of calcic carbonate & phosphate were passed in the stools.

tonitis following wounds, and occurs in the cancerous and tuberculous forms.

The amount of the effusion varies from half a litre to twenty or thirty litres. There are probably essential differences between the various kinds of peritonitis, and bacteriology is beginning to give us valuable information on this point. Of the species of micro-organisms which have been found in peritoneal exudates, the pyogenic micrococci and the *bacterium coli commune* are the most common, sometimes one species, often several species being found in the same case. The *streptococcus pyogenes* is by far the most frequent cause of puerperal peritonitis. This species, and still oftener the *staphylococcus pyogenes aureus*, or *albus*, are found in peritonitis consecutive to laparotomy. The *bacterium coli commune*, usually combined with other bacteria, is met with especially in peritonitis secondary to intestinal perforation. The *diplococcus pneumoniæ* has been found several times in peritoneal exudates. The *amœba coli* occurred in numbers in the thin fibrinous effusion in one of our cases of amœbic dysentery.

Symptoms.—In the perforative and septic cases the onset is marked by chilly feelings or an actual rigor with intense pain in the abdomen. In typhoid fever, when the sensorium is benumbed, the onset may not be noticed. The pain is general and is usually intense and aggravated by movements and pressure. A position is taken which relieves the tension of the abdominal muscles, so that the patient lies on the back with the thighs drawn up and the shoulders elevated. The greatest pain is usually below the umbilicus, but in peritonitis from perforation of the stomach pain may be referred to the back, the chest, or the shoulder. The respiration is superficial—costal in type—as it is painful to use the diaphragm. For the same reason the action of coughing is restrained, and even the movements necessary for talking are limited. In this early stage the sensitiveness may be great and the abdominal muscles are often rigidly contracted. If the patient is at perfect rest the pain may be very slight, and there are instances in which it is not at all marked, and may, indeed, be absent.

The abdomen gradually becomes distended and tense and is tympanitic on percussion. The pulse is rapid, small, and hard, and often has a peculiar wiry quality. It ranges from 110 to 150. The temperature may rise rapidly after the chill and reach 104° or 105°, but the subsequent elevation is moderate. The tongue at first is white and moist, but subsequently becomes dry and often red and fissured. Vomiting is an early and prominent feature and causes great pain. The contents of the stomach are first ejected, then yellowish and bile-stained fluid, and finally a greenish and, in rare instances, a brownish-black liquid with slight fæcal odor. The bowels may be loose at the onset and then constipation follows. Frequent micturition may be present, less often retention. The urine is usually scanty and high-colored, and contains a large quantity of indican.

The appearance of the patient when these symptoms have fully developed is very characteristic. The face is pinched, the eyes are sunken, and the expression is very anxious. The constant vomiting of fluids causes a wasted appearance, and the hands sometimes present the washer-woman's skin. Except in cholera, we see the Hippocratic facies more frequently in this than in any other disease—"*a sharp nose, hollow eyes, collapsed temples; the ears cold, contracted, and their lobes turned out; the skin about the forehead being rough, distended, and parched; the color of the whole face being brown, black, livid, or lead-colored.*" There are one or two additional points about the abdomen. The tympany is usually excessive, owing to the great relaxation of the walls of the intestines by inflammation and exudation. The splenic dulness may be obliterated, the diaphragm pushed up, and the apex beat of the heart dislocated to the fourth interspace. The liver dulness may be greatly reduced, or may, in the mammary line, be obliterated. It has been claimed that this is a distinctive feature of perforative peritonitis, but on several occasions I have been able to demonstrate that the liver dulness in the middle and mammary line was obliterated by tympanites alone. In the axillary line, on the other hand, the liver dulness, though diminished, may persist. Pneumoperitonæum following perforation more certainly obliterates the hepatic dulness. In such cases the fluid effused produces a dulness in the lateral region; but with gas in the peritonæum, if the patient is turned on the left side, a clear note is heard beneath the seventh and eighth ribs in the axillary line.

Effusion of fluid—ascites—is usually present except in some acute, rapidly fatal cases. The flanks are dull on percussion. The dulness may be movable, though this depends altogether upon the degree of adhesions. There may be considerable effusion without either movable dulness or fluctuation. A friction-rub may be present, as first pointed out by Bright, but it is not nearly so common in acute as in certain forms of chronic peritonitis.

Course.—The acute diffuse peritonitis usually terminates in death. The most intense forms may kill within thirty-six or forty-eight hours; more commonly death results in four or five days, or the attack may be prolonged to eight or ten days. The pulse becomes more rapid, all the symptoms are aggravated, the vomiting persists and the patient usually dies in collapse with a falling temperature. Occasionally death occurs with great suddenness, owing, possibly, to paralysis of the heart.

Diagnosis.—In typical cases the severe pain at onset, the distention of the abdomen, the tenderness, the fever, the gradual development of effusion, collapse symptoms, and the vomiting give a characteristic picture. Careful inquiries should at once be made concerning the previous condition, from which a clew can often be had as to the starting-point of the trouble. In young adults a considerable proportion of all cases depends upon perforating appendicitis, and there may be an account of previous

attacks of pain in the iliac region, or of constipation alternating with diarrhœa. In women the most frequent causes are suppurative processes in the pelvic viscera, either associated with salpingitis, abscesses in the broad ligaments, or acute puerperal infection. Perforation of gastric ulcer is more common also in women. It is not always easy to determine the cause. Many cases come under observation for the first time with the abdomen distended and tender, and it is impossible to make a satisfactory examination. In such instances the pelvic organs should be examined with the greatest care. In typhoid fever, if the patient is conscious, the sudden onset of pain, the development of great meteorism, and the aggravation of the general symptoms indicate clearly what has happened. When the patient is in deep coma, on the other hand, the perforation may be overlooked. The following conditions are most apt to be mistaken for acute peritonitis:

(*a*) *Acute Entero-colitis.*—Here the pain and distention and the sensitiveness on pressure may be marked. The pain is more colicky in character, the diarrhœa is more frequent, and the collapse is more extreme.

(*b*) *The So-called Hysterical Peritonitis.*—This has deceived the very elect, as almost every feature of genuine peritonitis, even the collapse, may be simulated. The onset may be sudden, with severe pain in the abdomen, tenderness, vomiting, diarrhœa, difficulty in micturition, and the characteristic decubitus. Even the temperature may be elevated. There may be recurrence of the attack. A case has been reported by Bristowe in which four attacks occurred within a year, and it was not until special hysterical symptoms developed that the true nature of the trouble was suspected.

(*c*) *Obstruction of the bowel*, as already mentioned, may simulate peritonitis, both having pain, vomiting, tympanites, and constipation in common. It may for a couple of days really be impossible to make a diagnosis in the absence of a satisfactory history.

(*d*) *Rupture of an abdominal aneurism or embolism of the superior mesenteric artery* may cause symptoms which simulate peritonitis. In the latter, sudden onset with severe pain, the collapse symptoms, frequent vomiting, and great distention of the abdomen may be present.

(*e*) I have already referred to the fact that acute hæmorrhagic pancreatitis may be mistaken for peritonitis. Lastly, a ruptured tubal pregnancy may resemble acute peritonitis. A patient was admitted to my wards in an enfeebled condition, with a thready pulse, distended and tender abdomen, and signs of fluid. The attack had come on suddenly four days before, when she had been in perfect health. She looked pale, the blood count was taken and found below three millions per cubic centimetre, with leucocytosis, a condition rather indicating anæmia from hæmorrhage. The abdomen was tapped with a fine aspirator needle and a bloody fluid withdrawn. The diagnosis of probable ruptured tubal pregnancy was made and the patient was transferred to the gynæcological department, where laparotomy was performed and the ruptured tube removed.

II. PERITONITIS IN INFANTS.

Peritonitis may occur in the fœtus as a consequence of syphilis, and may lead to constriction of the bowel by fibrous adhesions.

In the new-born a septic peritonitis may extend from an inflamed cord. Distention of the abdomen, slight swelling and redness about the cord, and not infrequently jaundice are present. It is an uncommon event, and existed in only four of fifty-one infants dying of inflammation of the cord and septicæmia (Runge).

During childhood peritonitis develops from causes similar to those affecting the adult. Perforative appendicitis is common. Peritonitis following blows or kicks on the abdomen occurs more frequently at this period. In boys injury while playing foot-ball may be followed by diffuse peritonitis. A rare cause in children is extension through the diaphragm from an empyema. There are on record instances of peritonitis occurring in several children at the same school, and it has been attributed to sewer-gas poisoning. It was in investigating an epidemic of this kind at the Wandsworth school, in London, that Anstie received the post-mortem wound of which he died.

III. LOCALIZED PERITONITIS.

The inflammation may be confined to the lesser peritonæum, particularly in cases of perforation of the stomach. A large air-containing abscess may form beneath the diaphragm, inducing the condition known as pyopneumothorax subphrenicus. More frequent is the circumscribed peritonitis due to inflammation of the appendix. If the vermiform process is free, adhesions take place which circumscribe the process. The most common situation is a localized abscess upon the psoas muscle, bounded by the cæcum on the right and the terminal portion of the ileum and its mesentery in front and on the left. The limitation may be complete, and post-mortem observation shows that healing follows in a large number of such cases. In other instances the localized peritonitis is more extensive and a large abscess cavity is gradually formed in the right iliac fossa, which may still be intraperitoneal, though shut off from the general sac. A more frequent cause of local peritonitis is inflammation about the uterus and Fallopian tubes, and here the primary disease is usually puerperal or gonorrhœal, less frequently tuberculous. The fimbriæ become adherent and closely matted to the ovary, and there is gradually produced a condition of thickening and matting of the parts in which the individual organs are scarcely recognizable. An acute process extending from this may involve only the pelvic membranes, being shut off from the general peritonæum by adhesions of the coils of the intestines.

is it not bands with

i & sub-phrenic

(b) appendicular

Appendix

c pelvic

IV. CHRONIC PERITONITIS.

The following varieties may be recognized: (*a*) **Local adhesive peritonitis,** a very common condition, which occurs particularly about the spleen, forming adhesions between the capsule and the diaphragm, about the liver, less frequently about the intestines and mesentery. Points of thickening or puckering on the peritonæum occur sometimes with union of the coils or fibrous bands. In a majority of such cases the condition is met accidentally post mortem. Two sets of symptoms may, however, be caused by these adhesions. When a fibrous band is attached in such a way as to form a loop or snare, a coil of intestine may pass through it. Thus, of the 295 cases of intestinal obstruction analyzed by Fitz, 63 were due to this cause. The second group is less serious and comprises cases with persistent abdominal pain of a colicky character, sometimes rendering life miserable. Instances of this kind have been successfully operated upon by Homans and H. A. Kelly.

(*b*) **Diffuse Adhesive Peritonitis.**—This is a consequence of an acute inflammation, either simple or tuberculous. The peritonæum is obliterated. On cutting through the abdominal wall, the coils of intestines are uniformly matted together and can neither be separated from each other nor can the visceral and parietal layers be distinguished. There may be thickening of the layers, and the liver and spleen are usually involved in the adhesions.

(*c*) **Proliferative Peritonitis.**—Apart from cancer and tubercle, which produce typical lesions of chronic peritonitis, the most characteristic form is that which may be described under this heading. The essential anatomical feature is great thickening of the peritoneal layers, usually without much adhesion. The cases are sometimes found with cirrhosis of the stomach. In one instance I found it in connection with a cirrhotic condition of the cæcum and the first part of the colon. In the inspection of a case of this kind there is usualiy moderate effusion, more rarely extensive ascites. The peritonæum is opaque-white in color, and everywhere thickened, often in patches. The omentum is usually rolled and forms a thickened mass transversely placed between the stomach and the colon. The peritonæum over the stomach, intestines, and mesentery is sometimes greatly thickened. The liver and spleen may simply be adherent, or there is a condition of chronic perihepatitis or perisplenitis, so that a layer of firm, almost gristly connective tissue of from one fourth to half an inch in thickness encircles these organs. Usually the volume of the liver is in consequence greatly reduced. The gastro-hepatic omentum may be constricted by this new growth and the calibre of the portal vein much narrowed. A serous effusion may be present. On account of the adhesions which form, the peritonæum may be divided into three or four different sacs, as is more fully described under the tuberculous peritonitis. In these cases the intestines are usually free, though the mesentery is greatly

shortened. There are instances of chronic peritonitis in which the mesentery is so shortened by this proliferative change that the intestines form a ball not larger than a cocoa-nut situated in the middle line, and after removal of the exudation can be felt as a solid tumor. The intestinal wall is greatly thickened and the mucous membrane of the ileum is thrown into folds like the valvulæ conniventes. This proliferative peritonitis is found frequently in the subjects of chronic alcoholism.

In all forms of chronic peritonitis a friction may be felt usually in the upper zone of the abdomen.

In some instances of chronic peritonitis the membrane presents numerous nodular thickenings, which may be mistaken for tubercles. They may be scattered in numbers on the membranes, and it may be extremely difficult, without the most careful microscopical examination, to determine their nature. J. F. Payne has described a case of this sort associated with disseminating growths throughout the liver which were not cancerous. It has been suggested that some of the cases of tuberculous peritonitis cured by operation have been of this nature, but histological examination would, as a rule, readily determine between the conditions. Miura, in Japan, has reported a case in which these nodules contained the ova of a parasite.

(*d*) **Chronic Hæmorrhagic Peritonitis.**—Blood-stained effusions in the peritonæum occur particularly in cancerous and tuberculous disease. There is a form of chronic inflammation analogous to the hæmorrhagic pachymeningitis of the brain. It was described first by Virchow, and is localized most commonly in the pelvis. Layers of new connective tissue form on the surface of the peritonæum with large wide vessels from which hæmorrhage occurs. This is repeated from time to time with the formation of regular layers of hæmorrhagic effusion. It is rarely diffuse, more commonly circumscribed.

V. NEW GROWTHS IN THE PERITONÆUM.

(*a*) **Tuberculous Peritonitis.**—This has already been considered.

(*b*) **Cancer of the Peritonæum.**—Although as a rule secondary to disease of the stomach, liver, or pelvic organs, cases of primary cancer are occasionally found. Secondary malignant peritonitis occurs in connection with all forms of cancer. It is usually characterized by a number of round tumors scattered over the entire peritonæum, sometimes small and miliary, at others large and nodular, with puckered centres. The disease most commonly starts from the stomach or the ovaries. The omentum is indurated, and, as in tuberculous peritonitis, forms a mass which lies transversely across the upper portion of the abdomen. Primary malignant disease of the peritonæum is extremely rare. Colloid has occurred, forming enormous masses, which in one case weighed over one hundred

2 Hæmorrhage into the peritoneum

pounds. Cancer of this membrane spreads, either by the detachment of small particles which are carried in the lymph currents and by the movements to distant parts, or by contact of opposing surfaces. It occurs more frequently in women than in men, and more commonly at the later period of life.

The *diagnosis* of cancer of the peritonæum is easy with a history of a local malignant disease; as when it occurs with ovarian tumor or with cancer of the pylorus. In cases in which there is no evidence of a primary lesion the diagnosis may be doubtful. The clinical picture is usually that of chronic ascites with progressive emaciation. There may be no fever. If there is much effusion nothing definite can be felt on examination. After tapping, irregular nodules or the curled omentum may be felt lying transversely across the upper portion of the abdomen. Unfortunately, this tumor upon which so much stress is laid occurs as frequently in tuberculous peritonitis and may be present in a typical manner in chronic proliferative form, so that in itself it has no special diagnostic value. Multiple nodules, if large, indicate cancer, particularly in persons above middle life. Nodular tuberculous peritonitis is most frequent in children. The presence about the navel of secondary nodules and indurated masses is more common in cancer. Inflammation, suppuration, and the discharge of pus from the navel rarely occur except in tuberculous disease. Considerable enlargement of the inguinal glands may be present in cancer. The nature of the fluid in cancer and in tubercle may be much alike. It may be hæmorrhagic in both; more often in the latter. The histological examination in cancer may show large multinuclear cells or groups of cells—the sprouting cell-groups of Foulis—which are extremely suggestive. The colloid cancer may produce a totally different picture; instead of ascitic fluid, the abdomen is occupied by the semi-solid gelatinous substance, and is firm, not fluctuating.

And, lastly, there are instances of echinococci in the peritonæum which may simulate cancer very closely. I have reported a case of this kind, in which the enlarged liver and the innumerable nodular masses in the peritonæum naturally led to this diagnosis.

VI. ASCITES (*Hydro-peritonæum*).

Definition.—The accumulation of serous fluid in the peritoneal cavity.

Etiology.—(1) **Local Causes.**—(*a*) Chronic inflammation of the peritonæum, either simple, cancerous, or tuberculous. (*b*) Portal obstruction in the terminal branches within the liver, as in cirrhosis, or by compression of the vein in the gastro-hepatic omentum, either by proliferative peritonitis, by new growths, or by aneurism. (*c*) Tumors of the abdomen. The solid growths of the ovaries may cause considerable ascites, which may

completely mask the true condition. The enlarged spleen in leukæmia, less commonly in malaria, may be associated with recurring ascites.

(2) **General Causes.**—The ascites is part of a general dropsy, the result of mechanical effects, as in heart-disease, chronic emphysema, and cirrhosis of the lung. In cardiac lesions the effusion is sometimes confined to the peritonæum, in which case it is due to secondary changes in the liver, or it has been suggested to be connected with a failure of the suction action of this organ, by which the peritonæum is kept dry. Ascites occurs also in the dropsy of Bright's disease, and in hydræmic states of the blood.

Symptoms.—A gradual uniform enlargement of the abdomen is the characteristic symptom of ascites. The physical signs are usually distinctive. (*a*) *Inspection.*—According to the amount of fluid the abdomen is protuberant and flattened at the sides. With large effusions, the skin is tense and may present the lineæ albicantes. Frequently the navel itself and the parts about it are very prominent. In many cases the superficial veins are enlarged and a plexus joining the mammary vessels can be seen. Sometimes it can be determined by pressure on these veins that the current is from below upward. In some instances, as in thrombosis or obliteration of the portal vein, these superficial abdominal vessels may be extensively varicose. About the navel in cases of cirrhosis there is occasionally a large bunch of distended veins, the so-called caput Medusæ.

(*b*) *Palpation.*—Fluctuation is obtained by placing the fingers of one hand upon one side of the abdomen and by giving a sharp tap on the opposite side with the other hand, when a wave is felt to strike as a definite shock against the applied fingers. Even comparatively small quantities of fluid may give this fluctuation shock. When the abdominal walls are thick or very fat, an assistant may place the edge of the hand or a piece of card-board in the front of the abdomen. A different procedure is adopted in palpating for the solid organs in case of ascites. Instead of placing the hand flat upon the abdomen, as in the ordinary method, the pads of the fingers only are placed lightly upon the skin, and then by a sudden depression of the fingers the fluid is displaced and the solid organ or tumor may be felt. By this method of "dipping" or displacement, as it is called, the liver may be felt below the costal margin, or the spleen, or sometimes solid tumors of the omentum or intestine.

(*c*) *Percussion.*—In the dorsal position with a moderate quantity of fluid in the peritonæum the flanks are dull, while the umbilical and epigastric regions, into which the intestines float, are tympanitic. This area of clear resonance may have an oval outline. Having obtained the lateral limit of the dulness on one side, if the patient then turns on the opposite side, the fluid gravitates to the dependent part and the uppermost flank is now tympanitic. In moderate effusions this movable dulness changes greatly in the different postures. Small amounts of fluid, probably under a litre, would scarcely give movable dulness, as the pelvis and the renal

regions hold a considerable quantity. In such cases it is best to place the patient in the knee-elbow position, when a dull note will be determined at the most dependent portion. By careful attention to these details mistakes are usually avoided.

The following are among the conditions which may be mistaken for dropsy: *Ovarian tumor*, in which the sac develops, as a rule, unilaterally, though when large it is centrally placed. The dulness is anterior and the resonance is in the flanks, into which the intestines are pushed by the cyst. Examination *per vaginam* may give important indications. In those rare instances in which gas develops in the cyst the diagnosis may be very difficult. Succussion has been obtained in such cases. A *distended bladder* may reach above the umbilicus. In such instances some urine dribbles away, and suspicion of ascites or a cyst is occasionally entertained. I once saw a trochar thrust into a distended bladder, which was supposed to be an ovarian cyst, and it is stated that John Hunter tapped a bladder, supposing it to be ascites. Such a mistake should be avoided by careful catheterization prior to any operative procedures. And lastly, there are large pancreatic or hydatid cysts in the abdomen which may simulate ascites.

Nature of the Ascitic Fluid.—Usually this is a clear serum, light yellow in the ascites of anæmia and Bright's disease, often darker in color in cirrhosis of the liver. The specific gravity is low, seldom more than 1·010 or 1·015. In the fluid of ovarian cysts the specific gravity is high, 1·020 or over. It is albuminous and sometimes coagulates spontaneously. Hæmorrhagic effusion usually occurs in cancer and tuberculosis, and occasionally in cirrhosis. I have already referred to the instances of hæmorrhagic effusion in connection with ruptured tubal pregnancy. A chylous, milky exudate is occasionally found. Busey has collected thirty-three cases from the literature. There are, as Quincke has pointed out, two distinct varieties, a fatty and a chylous, which may be distinguished by the microscope, as in the former there are distinct fat-globules. These cases have been sometimes connected with peritoneal or mesenteric cancer. In the true chylous ascites the fluid is turbid and milky. In some of the cases, as in Whitla's, a perforation of the thoracic duct has been found. The condition does not necessarily follow obliteration of the thoracic duct. Mild grades of chylous ascites, which are occasionally found clinically, may be due to the fact that the patient upon a milk diet has a permanent lipæmia, such as is present in young animals and in diabetics, in whom the liquor sanguinis is always fatty. Under such circumstances an exudate may contain enough of the molecular base of the chyle to produce turbidity of the fluid. Some of the cases have been associated with filariosis.

Treatment of the Previous Conditions.—(*a*) **Acute Peritonitis.**—Rest is enjoined upon the patient by the severe pain which follows the slightest movement, and he should be propped in the position

which gives him greatest relief. For the pain morphia should be injected hypodermically in full doses. In an adult it is better to give a third or half a grain at once, and subsequently at intervals repeat it in smaller doses, as are necessary. The action of the drug should be carefully watched and the patient should not be allowed to pass into such a degree of unconsciousness that he cannot be aroused. The respiration and the condition of the pupils also give valuable information. The amount of opium which has been given in certain instances is remarkable, and indicates a tolerance of the drug. The doses given by the late Alonzo Clark, of New York, may be truly termed heroic. Austin Flint notes that a patient under the care of this physician took "in the first twenty-four hours, of opium and the sulphate of morphia, a quantity equivalent to 106 grains of opium; in the second twenty-four hours she took 472 grains; on the third day, 236 grains; on the fourth day, 120 grains; on the fifth day, 54 grains; on the sixth day, 22 grains; on the seventh day, 18 grains; after which the treatment was suspended." It is unnecessary to use these enormous doses, as, even when the pain is most intense, from a third to a half grain of morphia every few hours will usually keep the patient thoroughly under the influence of the drug. In a robust, strong patient, seen at the outset, twenty leeches applied over the abdomen will give great relief.

Local applications—either hot turpentine stupes or cloths wrung out of ice-water—may be laid upon the abdomen. The patients sometimes declare that they are greatly relieved by the latter.

The question of the use of purgatives in peritonitis has of late been warmly discussed. Lawson Tait and other gynæcologists have used the saline purges with the greatest benefit in post-operation peritonitis. Theoretically it appears correct to give salines in concentrated form, which cause a rapid and profuse exosmosis of serum from the intestinal vessels, relieving the congestion and reducing the œdema, which is one important factor in causing the meteorism. It is also urged that the increased peristalsis prevents the formation of adhesions. In reading the reports of these successful cases, one is not always convinced, however, that peritonitis actually existed. Still, in cases of acute peritonitis due to extension or following operation or in septic conditions the judgment of many careful men is decidedly in favor of the use of salines. I cannot speak from personal experience on this question. The majority of cases of peritonitis which come under the care of the physician follow lesions of the abdominal viscera or are due to perforation of ulcer of the stomach, the ileum, or the appendix. In such cases, particularly in the large group of appendix cases, to give saline purgatives is, to say the least, most injudicious treatment. The safety of the patient lies in the restriction of the peristalsis and the localization of the inflammation, for which purpose opium alone is of service. In these instances rectal injections should be employed to relieve the large bowel. No symptom in acute peritonitis is more serious than

the tympanites, and none is more difficult to meet. The use of the long tube and injections containing turpentine may be tried. Drugs by the mouth cannot be retained.

For the vomiting, ice and small quantities of soda water may be employed. The patient should be fed on milk, but if the vomiting is distressing it is best not to attempt to give food by the mouth, but to use small nutrient enemata. In all cases of peritonitis it is best to have a surgeon in consultation early in the disease, as the question of operation may come up at any moment. I have already mentioned the conditions under which laparotomy is indicated in perforative appendicitis. The acute purulent cases, particularly those in which the streptococci occur, usually die; but although the results of operative interference in this form have not as yet been very brilliant, the condition, we must remember, is almost hopeless, and too often there has been unnecessary delay in calling in surgical aid. In the acute forms of tuberculous peritonitis operation appears to be more hopeful, but they are not always successful.

(*b*) **Chronic Peritonitis.**—For the cases of chronic proliferative peritonitis very little can be done. The treatment is practically that of ascites. In all these forms, when the distention becomes extreme, tapping is indicated. The treatment of tuberculous peritonitis has fallen largely into the hands of the surgeons, and the results in many cases are very good. According to the statistics of Maurange,* of 71 cases, 28 survived the operation for more than a year. Of 26 additional cases which I have collected,† 14 were dead at the time of the report. Within two years and three months there were six operations performed at the Johns Hopkins Hospital in tuberculous peritonitis, with four recoveries.

(*c*) **Ascites.**—The treatment depends somewhat on the nature of the case. In cirrhosis early and repeated tapping may give time for the establishment of the collateral circulation, and temporary cures have followed this procedure. Permanent drainage with Southey's tube, incision, and washing out the peritonæum have also been practised. In the ascites of heart and renal disease the cathartics are most satisfactory, particularly the bitartrate of potash, given alone or with jalap, and the large doses of salts given an hour before breakfast with as little water as possible. These sometimes cause rapid disappearance of the effusion, but they are not so successful in ascites as in pleurisy with effusion. The stronger cathartics may sometimes be necessary. The ascites forming part of the general anasarca of Bright's disease will receive consideration under another section.

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* Paris Thesis, 1889.

† On Tuberculous Peritonitis, Johns Hopkins Hospital Reports, 1890.

SECTION IV.

DISEASES OF THE RESPIRATORY SYSTEM.

I. DISEASES OF THE NOSE.

1. ACUTE CORYZA.

Acute catarrhal inflammation of the upper air-passages, popularly known as a "catarrh" or a "cold," is usually an independent affection, but may precede the development of another disease.

Etiology.—It prevails most extensively in the changeable weather of the spring and early winter, and may occur in epidemic form, many cases developing in a community within a few weeks. These outbreaks are very like, though less intense than the epidemic influenza, cases of which may begin with symptoms of ordinary coryza. The disease probably depends upon a micro-organism. Irritating fumes, such as those of iodine or ammonia, also may cause an acute catarrh of the nose.

Symptoms.—The patient feels indisposed, perhaps chilly, has slight headache, and sneezes frequently. In severe cases there are pains in the back and limbs. There is usually slight fever, the temperature rising to 101°. The pulse is quick, the skin is dry, and there are all the features of a feverish attack. At first the mucous membrane of the nose is swollen, "stuffed up," and the patient has to breathe through the mouth. A thin, clear, irritating secretion flows, and makes the edges of the nostrils sore. The mucous membrane of the tear-ducts is swollen, so that the eyes weep and the conjunctivæ are injected. With the nasal catarrh there is slight soreness of the throat and stiffness of the neck; the pharynx looks red and swollen, and sometimes the act of swallowing is painful. The larynx also may be involved, and the voice becomes husky or is even lost. If the inflammation extends to the Eustachian tubes there may be impairment of the hearing. Owing to the swelling of the nasal mucosa, the sense of smell and, in part, the sense of taste are lost. In more severe cases there are bronchial irritation and cough. Occasionally there is an outbreak of labial or nasal herpes. Usually within thirty-six hours the nasal secretion becomes turbid and more profuse, the swelling of the mucosa subsides, the patient gradually becomes able to breathe through the nostrils, and within

For the

The Fluid Extract of Hamamelis 'snuffed' from the hand every two or three hours is much better.

four or five days the symptoms disappear, with the exception of the increased discharge from the nose and upper pharynx. There are rarely any bad effects from a simple coryza. When the attacks are frequently repeated, the disease may become chronic.

The *diagnosis* is always easy, but caution must be exercised lest the initial catarrh of measles or severe influenza should be mistaken for the simple coryza.

Treatment.—Many cases are so mild that the patients are able to be about and to attend to their work. If there are fever and constitutional disturbance, the patient should be kept in bed and should take a simple fever mixture, and at night a drink of hot lemonade and a full dose of Dover's powder. Many persons find great benefit from the Turkish bath. For local treatment, particularly in the early stage, when the mucous membrane is swollen and there is a distressing sense of tightness and pain over the frontal sinuses, cocaine is very useful and sometimes gives immediate relief. The four per cent solution may be injected into the nostrils, or cotton-wool soaked in the solution may be inserted into them. Later, the snuff recommended by Ferrier is advantageous, composed, as it is, of morphia (gr. ij), bismuth (ʒ iv), acacia powder (ʒ ij). This may occasionally be blown or snuffed into the nostrils. Coryza is rarely serious in itself, but renders the subject more susceptible to other affections. The attacks should therefore never be slighted, and in young children and in the old especial care should be taken during convalescence.

II. CHRONIC NASAL CATARRH

(*Rhinitis simplex; Rhinitis hypertrophica; Rhinitis atrophica*).

In *simple chronic catarrh* there is increased irritability of the mucous membrane, particularly of the erectile tissue on the septum and turbinated bones. There is a tendency to frequent stoppage of one or both nostrils and the patient very easily catches cold. The secretion is at first clear and afterward thick and tenacious. The sense of smell is not specially disturbed at this stage. With the mirror the mucous membrane looks congested and swollen and the veins may be distended.

In *hypertrophic rhinitis*, which is usually a sequel of the former condition, the nasal passages are obstructed, chiefly by enlargement of the lower turbinated bodies and swelling of the mucous membrane of the septum. Very often there is hypertrophy of the adenoid tissue in the vault of the pharynx and of the mucous membrane about the orifices of the Eustachian tubes. The two conditions frequently go together as expressed in the designation, chronic naso-pharyngeal catarrh. The symptoms of this hypertrophic rhinitis may be local or general.

The most important local symptom is the obstruction of the passage of air through the nostrils, so that the patients become mouth-breathers.

During the day this may not be very distressing, but at night the mouth and throat get extremely dry and the sleep is disturbed. The voice becomes nasal in quality and in advanced cases, when the Eustachian tubes are obstructed, there may be deafness. It should ever be borne in mind by the practitioner that a very large proportion of all cases of deafness originate in chronic naso-pharyngeal catarrh. The general symptoms in these cases, particularly in children, are of the greatest importance, and have been considered more fully under chronic pharyngeal catarrh and mouth-breathing. Suffice it here to say that there is produced in children a characteristic facies, associated often with mental dulness and changes in the form of the thorax.

Atrophic rhinitis, which is also known under the names coryza fetida and ozæna, may be a sequence of the hypertrophic form. Ozæna is only a symptom, and is met with in many ulcerative conditions of the nostrils, particularly as a result of syphilis, foreign bodies, caries and necrosis of the bones, and glanders. Fortunately, the atrophic form by no means necessarily follows the hypertrophic stage. The cases are much more frequent in women than in men, and usually occur early in life. The mucous membrane is thin and covered with grayish crusts which, when removed, show a slightly excoriated surface, but true ulcers are rarely seen. The erectile tissue is completely atrophied by a process of slow connective-tissue growth, or, as J. N. Mackenzie calls it, a cirrhosis. The mucous membrane of the pharynx is usually dry and glazed.

The symptoms are most distinctive, owing to the horrible odor which comes from the nose, and of which, fortunately, the patient is himself unconscious, because the sense of smell is lost. The secretion, which is puriform, dries and forms large crusts, which are dislodged by picking or which gradually fall off. The cause of the offensive odor has been much discussed—whether it is due to a special organism or to specially favorable conditions for the growth and development of the germs of putrefaction. Probably the latter view is correct.

The *treatment* of hypertrophic rhinitis consists in the thorough cleansing of the nasal passages, the removal of the pharyngeal growths, and the reduction of the hypertrophied nasal mucosa. Operative procedures are necessary in a majority of the cases, and the practitioner should early call to his assistance the specialist. It is sad to think of the misery which has been entailed upon thousands of people owing to neglect of naso-pharyngeal catarrh by parents and physicians.

The treatment of atrophic rhinitis comes more properly under the special monographs.

III

Fibrinous Rhinitis

III. AUTUMNAL CATARRH (*Hay Fever*).

An affection of the upper air-passages, often associated with asthmatic attacks, due to the action of certain stimuli upon a hypersensitive mucous membrane.

This affection was first described in 1819 by Bostock, who called it *catarrhus æstivus*. Morrill Wyman, of Cambridge, Mass., wrote a monograph on the subject, and described two forms, the "June cold," or "rose cold," which comes on in the spring, and the autumnal form which, in this country, does not develop until August and September, and never persists after a severe frost. Blakley studied its connection with the pollen of various grasses and flowers. The late George M. Beard made many careful observations on the disease. Until recently this form of catarrh was believed to result exclusively from the action of certain irritants on the mucous membrane of the nose, particularly the pollen of plants, which, as the experiments of Blakley showed, play an important *rôle* in the disease. Other emanations also may induce an attack, as in the case of the late Austin Flint, who was liable to coryza, or even asthma, if he slept on a certain sort of feather pillow. This, however, is only one factor in the disease. A second, most important one, was discovered in the condition of the nasal mucous membrane in these cases. Voltolini, of Breslau, in 1871, observed the cure of a case of asthma by the removal of a nasal polypus. Since that date the observations of Hack, in Germany, and particularly of Daly, of Pittsburg; Roe, of Rochester; John N. Mackenzie, of Baltimore; and Harrison Allen, of Philadelphia, have demonstrated the association of asthmatic attacks with nasal disease. Daly discovered that in a large proportion of the cases of hay asthma there was local disease of the mucous membrane of the nose, the cure of which rendered the patient insusceptible to conditions previously exciting the attacks. This has been abundantly confirmed. Still identical lesions exist in many people who never suffer with the disease, so that there must be a third factor, a neurotic constitution. In the etiology of hay fever, then, these three elements prevail—a nervous constitution, an irritable nasal mucosa, and the stimulus.

The disease affects certain families, particularly, it is said, those with a neurotic taint. The peculiarity may occur through several generations. It is certainly more common in the United States than in Europe, and much more common in the United States than in Canada. The United States Hay Fever Association now numbers thousands of members.

Dwellers in cities are more subject than residents in the country. The structural peculiarities of the nasal mucous membrane are those of hypertrophic rhinitis. Harrison Allen states that the inferior turbinated bones lie well above the floor of the nostrils, which renders the mucous membrane more liable to irritation from inhaled substances. Deflection of the septum, hypertrophy of the soft parts, and excessive hyperæsthesia, so that

the mere touch with a probe may be sufficient to induce an attack, are common conditions.

Symptoms.—These are, in a majority of the cases, very like those of ordinary coryza. There may, however, be much more headache and distress, and some patients become very low-spirited. Cough is a common symptom and may be very distressing. Paroxysms of asthma may develop, so like as to be indistinguishable from the ordinary bronchial form. The two conditions may indeed alternate, the patient having at one time an attack of common hay fever and at another, under similar circumstances, an attack of bronchial asthma. Of the immediate exciting causes of the attack, unquestionably in a majority of the cases coming on in the autumn there is an association with the presence of pollen in the atmosphere, but this is only one of a host of exciting causes. In certain persons the paroxysms may develop at any season from sudden changes in the temperature. An attack may even come on through association of ideas. The well-known experiment of J. N. Mackenzie, of inducing an attack in a susceptible person by offering her an artificial rose to smell, strikingly illustrates the neurotic element in the disease.

Treatment.—This may be comprised under three heads: First, since the disease appears in many instances to be a form of chronic neurosis, remedies which improve the stability of the nervous system may be employed—such as arsenic, phosphorus, and strychnia. Second, climatic. Dwellers in the cities of the Atlantic sea-board and of the Central States enjoy complete immunity in the Adirondacks and White Mountains. As a rule the disease is aggravated by residence in agricultural districts. The dry mountain air is unquestionably the best; there are cases, however, which do well at the seaside. Third, the thorough local treatment of the nose, particularly the destruction of the vessels and sinuses over the sensitive areas.

IV. EPISTAXIS.

Etiology.—Bleeding from the nose may result from local or constitutional conditions. Among local causes may be mentioned traumatism, picking or scratching the nose, new growths, and the presence of foreign bodies. In chronic nasal catarrh bleeding is not infrequent. The blood may come from one or both nostrils. The flow may be profuse after an injury, but is soon checked and is very rarely fatal. Occasionally profuse and fatal hæmorrhage occurs as a result of injury to the skull. In a remarkable case of this kind, coming on some weeks after the receipt of the injury, I found that there had been a fracture across the sphenoid bone and an erosion had taken place into the carotid artery, just where it runs closest to the sphenoidal sinuses. The young man had completely recovered from the effects of the injury, and the fatal hæmorrhage took place as he was stooping over to wash his face.

Among general conditions with which nose-bleeding is associated, the following are the most important: It occurs with great frequency in growing children, particularly about the age of puberty; more frequently in the delicate than in the strong and vigorous.

Epistaxis is a very common event in persons of so-called plethoric habit. It is stated sometimes to precede, or to indicate a liability to, apoplexy, but this is very doubtful.

In venous engorgement, due to heart or pulmonary disease, epistaxis is not common and there may be a most extreme grade of cyanosis without its occurrence. In balloon and mountain ascensions, in the very rarefied atmosphere, hæmorrhage from the nose is a common event. In hæmophilia the nose ranks first of the mucous membranes from which bleeding arises. It occurs in all forms of chronic anæmias. It precedes the onset of certain fevers, more particularly typhoid, with which it seems associated in a special manner. Vicarious epistaxis has been described in cases of suppression of the menses. Lastly, it is said to be brought on by certain psychical impressions, but the observations on this point are not trustworthy. The blood in epistaxis results from capillary oozing or diapedesis. The mucous membrane is deeply congested and there may be small ecchymoses. The bleeding area is usually in the respiratory portion of one nostril and upon the cartilaginous septum.

Symptoms.—Slight hæmorrhage is not associated with any special features. When the bleeding is protracted the patients have the more serious manifestations of loss of blood. In the slow dripping which takes place in some instances of hæmophilia, there may be formed a remarkable blood tumor projecting from one nostril and extending even below the mouth.

Death from ordinary epistaxis is very rare. The more blood is lost, the greater is the tendency to clotting with spontaneous cessation of the bleeding.

The *diagnosis* is usually easy. One point only need be mentioned; namely, that bleeding from the posterior nares occasionally occurs during sleep and the blood trickles into the pharynx and may be swallowed. If vomited, it may be confounded with hæmatemesis; or, if coughed up, with hæmoptysis.

Treatment.—In a majority of the cases the bleeding ceases of itself. Various simple measures may be employed, such as holding the arms above the head, the application of ice to the nose, or the injection of cold or hot water into the nostrils. Astringents, such as zinc, alum, or tannin, may be used; and the old-fashioned and sometimes successful remedy, a cobweb, may be introduced into the nostrils. If the bleeding comes from an ulcerated surface, an attempt should be made to apply chromic acid or to cauterize. If the bleeding is at all severe and obstinate, the posterior nares should be plugged. Ergot may be given internally or hypodermically.

II. DISEASES OF THE LARYNX.

I. ACUTE CATARRHAL LARYNGITIS.

This may come on as an independent affection or in association with general catarrh of the upper respiratory passages.

Etiology.—Many cases are due to catching cold or to overuse of the voice; others develop in consequence of the inhalation of irritating gases. It may occur in the general catarrh associated with influenza and measles. Very severe laryngitis is excited by traumatism, either injuries from without or the lodgment of foreign bodies. It may be caused by the action of very hot liquids or corrosive poisons.

Symptoms.—There is a sense of tickling referred to the larynx; the cold air irritates and, owing to the increased sensibility of the mucous membrane, the act of inspiration may be painful. There is a dry cough, and the voice is altered. At first it is simply husky, but soon phonation becomes painful, and finally the voice may be completely lost. In adults the respirations are not increased in frequency, but in children dyspnœa is not uncommon and may occur in spasmodic attacks. If much œdema accompanies the inflammatory swelling, there may be urgent dyspnœa.

The laryngoscope shows a swollen and tumefied mucous membrane of the larynx, particularly the ary-epiglottidean folds. The vocal cords have lost their smooth and shining appearance and are reddened and swollen. Their mobility also is greatly impaired, owing to the infiltration of the adjoining mucous membrane and of the muscles. A slight mucoid exudation covers the parts. The constitutional symptoms are not severe. There is rarely much fever, and in many cases the patient is not seriously ill. Occasionally cases come on with greater intensity, the cough is very distressing, deglutition is painful, and there may be urgent dyspnœa.

Diagnosis.—There is rarely any difficulty in determining the nature of a case if a satisfactory laryngoscopic examination can be made. The severer forms may simulate œdema of the glottis. When the loss of voice is marked, the case may be mistaken for one of nervous aphonia, but the laryngoscope would decide the question at once. Much more difficult is the diagnosis of acute laryngitis in children, particularly in the very young, in whom it is so hard to make a proper examination. From ordinary laryngismus it is to be distinguished by the presence of fever, the mode of onset, and particularly the coryza and the previous symptoms of hoarseness or loss of voice. Membranous laryngitis may at first be quite impossible to differentiate, but in a majority of cases of this affection there are patches on the pharynx and early swelling of the cervical glands. The symptoms, too, are much more severe.

Treatment.—Rest of the larynx should be enjoined, so far as phonation is concerned. In cases of any severity the patient should be kept

in bed. The room should be at an even temperature and the air saturated with moisture. Early in the disease, if there is much fever, aconite and citrate of potash can be given, and for the irritating painful cough a full dose of Dover's powder at night. An ice-bag externally often gives great relief.

II. CHRONIC LARYNGITIS.

Etiology.—The cases usually follow repeated acute attacks. The most common causes are overuse of the voice, particularly in persons whose occupation necessitates shouting in the open air. The constant inhalation of irritating substances, as tobacco-smoke, may also cause it.

Symptoms.—The voice is usually hoarse and rough and in severe cases may be almost lost. There is usually very little pain; only the unpleasant sense of tickling in the larynx, which causes a frequent desire to cough. With the largyngoscope the mucous membrane looks swollen, but much less red than in the acute condition. In association with the granular pharyngitis, the mucous glands of the epiglottis and of the ventricles may be involved.

Treatment.—The nostrils should be carefully examined, since in some instances chronic laryngitis is associated with and even dependent upon obstruction to the free passage of air through the nose. Local application must be made directly to the larynx, either with a brush or by means of a spray. Among the remedies most recommended are the solutions of nitrate of silver, chlorate of potash, perchloride of zinc, and tannic acid. Insufflations of bismuth are sometimes useful.

Among directions to be given are the avoidance of heated rooms and loud speaking, and abstinence from tobacco and alcohol. The throat should not be too much muffled, and morning and evening the neck should be sponged with cold water.

III. ŒDEMATOUS LARYNGITIS.

Etiology.—Œdema of the glottis, or, more correctly, of the structures which form the glottis, is a very serious affection which is met with (*a*) as a rare sequence of ordinary acute laryngitis, whether due to cold or to the application of irritants. (*b*) In chronic diseases of the larynx, as syphilis or tubercle. (*c*) In severe inflammatory diseases like diphtheria, in erysipelas of the neck, and in various forms of cellulitis. (*d*) Occasionally in the acute infectious diseases—scarlet fever, typhus, or typhoid. In Bright's disease, either acute or chronic, there may be a rapidly developing œdema. The connection with Bright's disease has been disputed and is certainly rare. I have met with two instances, one in scarlatinal

nephritis and the other in chronic interstitial nephritis. Both cases proved fatal in a short time.

Symptoms.—There is dyspnœa, increasing in intensity, so that within an hour or two the condition becomes very serious. There is sometimes marked stridor in respiration. The voice becomes husky and disappears. The laryngoscope shows enormous swelling of the epiglottis, which can sometimes be felt with the finger or even seen when the tongue is strongly depressed with a spatula. The ary-epiglottidean folds are the seat of the chief swelling and may almost meet in the middle line. Occasionally the œdema is below the true cords.

The diagnosis is rarely difficult, inasmuch as even without the laryngoscope the swollen epiglottis can be seen or felt with the finger. The disease is very fatal.

Treatment.—An ice-bag should be placed on the larynx and the patient given ice to suck. If the symptoms are urgent, the throat should be sprayed with a strong solution of cocaine, and the swollen epiglottis scarified. If relief does not follow, tracheotomy should immediately be performed. The high rate of mortality is due to the fact that this operation is as a rule too long delayed.

IV. MEMBRANOUS LARYNGITIS (*Croup*).

Inflammation of the larynx, with membranous exudation occurs: (1) As a simple, non-specific, non-contagious affection, local in its nature, and not occurring in epidemics. It is unquestionably a rare disease. (2) As an effect of diphtheria, in which the disease may be limited to the larynx, but most commonly is associated with exudation on the pharynx or tonsils.

Etiology.—Membranous croup is now regarded by many authorities as always diphtheritic, and while it must be acknowledged that this is so in the great majority of instances, there are cases, few in number, it is true, in which it is not possible to assign this origin. The question may be settled by the presence or absence of Loeffler's bacillus, which is a definite criterion of diphtheritic pseudo-membrane. At the Montreal General Hospital, which received annually an exceptionally large number of cases of diphtheria, we were in the habit of regarding all the laryngeal cases as true diphtheria, even when no patches could be seen on the tonsils. On several occasions, in cases of this kind, I have been able to demonstrate post mortem that the exudation had extended at the back of the tonsils or on the posterior pillars of the fauces. On the other hand, twice at the Infant's Home I saw cases, sporadic in their nature, coming on suddenly without much fever, with extensive fibrinous exudation, necessitating tracheotomy, but without a trace of pharyngeal exudation. Although the conditions were most favorable for the spread of

the infection in the Home, no other cases occurred. Provisionally, at any rate, I still hold that there is a separate independent affection, a non-contagious membranous croup. Yet I am willing to acknowledge that the large majority of the cases of fibrinous laryngitis are due to the poison of diphtheria. It is particularly desirable that a bacteriological examination should be made of the membrane in the former class of cases.

The disease affects young children, particularly between the ages of two and six. Cases under two and over seven are very rare. Statistics show that boys are more often attacked than girls Cases occur occasionally with scarlet fever and measles.

Morbid Anatomy.—On inspection of the larynx of a child dead of membraneous croup, the *rima* is seen filled with mucus or with a shreddy material which, when washed off carefully, leaves the mucosa covered by a thin grayish-yellow membrane, which may be uniform or in patches. It covers the ary-epiglottic folds and the true cords, and may be continued into the ventricles or even into the trachea. Above, it may involve the epiglottis. It varies much in consistency. I have seen fatal cases in which the exudation was not actually membranous, but rather friable and granular. It may form a thick, even stratified membrane, which fills the entire glottis. The exudation may extend down the trachea and into the bronchi, and may pass beyond the epiglottis to the fauces. Usually it can be readily stripped off from the mucous membrane of the larynx and leaves exposed the swollen and injected mucosa. On examination it is seen that the fibrinous material has involved chiefly the epithelial lining and has not greatly infiltrated the subjacent tissues.

Symptoms.—Naturally, the clinical symptoms are almost identical in the non-specific and specific forms of membranous laryngitis.

The affection begins like an acute laryngitis with slight hoarseness and rough cough, to which the term croupy has been applied. After these symptoms have lasted for a day or two with varying intensity, the child suddenly becomes worse, usually at night, and there are signs of impeded respiration. At first the difficulty in breathing is paroxysmal, due probably to more or less spasm of the muscles of the glottis. Soon the dyspnœa becomes continuous, inspiration and expiration become difficult, particularly the latter, and with the inspiratory movements the epigastrium and lower intercostal spaces are retracted. The voice is husky and may be reduced to a whisper. The color gradually changes and the imperfect aëration of the blood is shown in the lividity of the lips and finger-tips. Restlessness comes on and the child tosses from side to side, vainly trying to get breath. Occasionally, in a severer paroxysm, portions of membrane are coughed out. The fever in non-specific membranous laryngitis is rarely high and the condition of the child is usually very good at the time of the onset. The pulse is always increased in frequency and if cyanosis be present is small. In favorable cases the dyspnœa is not very urgent, the color of the face remains good, and after one or two paroxysms the child goes to sleep and

wakes in the morning, perhaps without fever and feeling comfortable. The attack may recur the following night with greater severity. In unfavorable cases the dyspnœa becomes more and more urgent, the cyanosis deepens, the child, after a period of intense restlessness, sinks into a semi-comatose state, and death finally occurs from poisoning of the nerve centres by carbon dioxide. In diphtheritic laryngitis the onset is usually less sudden and is preceded by a longer period of indisposition. As a rule, there are pharyngeal symptoms. The constitutional disturbance, too, is more severe, the fever higher, and there may be swelling of the glands of the neck. Inspection of the fauces may show the presence of false membranes on the pillars or on the tonsils. This, however, is held by some not to be an invariable evidence of the diphtheritic nature of the inflammation. Fagge held that non-contagious membranous croup may spread upward from the larynx just as diphtheritic inflammation is in the habit of spreading downward from the fauces. Ware, of Boston, whose essay on croup is perhaps the most solid contribution to the subject made in this country, reported the presence of exudate in the fauces in 74 out of 75 cases of croup. These observations were made prior to 1840, during periods in which diphtheria was not epidemic to any extent in Boston. In protracted cases pulmonary symptoms may develop, which are sometimes due to the difficulty in expelling the muco-pus from the tubes; in others, the false membrane extends into the trachea and even into the bronchial tubes. During the paroxysm the vesicular murmur is scarcely audible, but the laryngeal stridor may be loudly communicated along the bronchial tubes.

Diagnosis.—Membranous laryngitis must be distinguished from ordinary simple laryngitis and from certain spasmodic affections. Simple catarrhal laryngitis rarely induces such severe symptoms, occurs more suddenly, nearly always at night, and the hoarseness and implication of the voice are not nearly so marked. The presence of preceding symptoms is one of the most important diagnostic distinctions between the false and the true croup. By hoarseness, dyspnœa, and signs of membrane on the fauces or tonsils the existence of membranous laryngitis may be definitely determined. Occasionally simple laryngitis induces swelling sufficient to cause marked dyspnœa and hoarseness and may, indeed, prove fatal. Of course, true membranous laryngitis may follow the catarrhal form. In laryngismus the attack comes on suddenly and is not associated with either cough or hoarseness. The child is seized with a difficulty in breathing; the inspirations are crowing in character, and the dyspnœa rapidly becomes urgent, so that symptoms of suffocation supervene, sometimes within less than a minute; the spasm then relaxes and the child appears to be in its normal condition. It is most commonly met with in rickety children.

The diagnosis between diphtheritic and non-diphtheritic membranous laryngitis is by no means easy, and, as mentioned above, many excellent authorities hold the diseases to be identical. The following are the chief points of distinction, which refer to general rather than to local conditions: The

non-specific affection generally begins in the larynx and the fauces are but slightly, if at all, affected. It is not infectious. Cases develop in institutions under circumstances most favorable to the spread of the disease, but other children are not attacked. It has none of the serious asthenic symptoms of diphtheria, and it is not followed by paralysis. It occurs almost exclusively in very young children, whereas diphtheritic laryngitis is not at all uncommon in adults.

Prognosis.—True croup, whether simple or diphtheritic, with a mortality of from sixty to eighty per cent, is an extremely fatal disease. When it attacks healthy children and is not secondary to some febrile affection, the outlook is more hopeful. Even a very limited exudation may prove fatal. On several occasions, in performing post-mortems in fatal cases, I have been astonished to find such a slight involvement of the larynx; in some instances scarcely more than a granular exudation covering the cords and folds. A fatal result is almost inevitable when the disease extends to the bronchi.

Treatment.—As the cases rarely come under observation until the membrane is formed, the main medicinal indication is to favor its separation. The air of the room should be saturated with moisture from an atomizer and the throat should be sprayed with lime-water.

In young children topical application to the larynx itself is extremely difficult and in many instances impossible. Good results have followed the passage of a sponge-probang with a strong solution of nitrate of silver. It is an easy matter to recommend such measures, but very difficult to carry them out. The administration of a brisk emetic will sometimes bring away portions of the false membrane; ipecacuanha or the turpeth mineral is the most suitable. Of late years there has been a return to the mercurial treatment of membranous laryngitis, but I have not seen such results from its use as would justify a recommendation of it. Continuous hot applications to the throat are usually much more grateful than the ice-bag, so highly recommended by some practitioners. With the first indication of defective aëration of the blood it is well to let the child inhale oxygen, which may be conveniently passed into a tent made of sheets on the bed.

In very many cases the obstruction reaches such a grade that the propriety of intubation or tracheotomy is raised. One great advantage of the former is that it may be suggested at an earlier stage with more likelihood of gaining the consent of the parents.

The statistics of tracheotomy are not very satisfactory, as only a fourth to a third of the cases recover.

The general treatment of these cases is of great importance. In the first place the child should be isolated, since it is often impossible to say whether the case is specific or not. Much of the success in the case depends upon careful nursing. There is no disease which requires greater care, coolness, and judgment on the part of the attendants. The diet

should consist of milk and beef-juices. Water should be given freely to the child, and if the pulse shows signs of failing, stimulants should at once be administered. The extreme restlessness calls for anodynes, but they must be administered with great care; bromide and chloral are to be preferred to opium. In cases in which the dyspnœa comes on in paroxysms, as if due to spasm, I have seen great benefit follow the inhalation of chloroform.

V. SPASMODIC LARYNGITIS (*Laryngismus stridulus*).

Spasm of the glottis is met with in many affections of the larynx, but there is a special disease in children which has received the above-mentioned names.

Etiology.—A purely nervous affection, without any inflammatory condition of the larynx, it occurs in children between the ages of six months and three years, and is most commonly seen in connection with rickets. It is also associated with tetany. Often the attack comes on when the child has been crossed or scolded. Mothers sometimes call the attacks "passion fits" or attacks of "holding the breath." It was supposed at one time that they were associated with enlargement of the thymus, and they therefore received the name of *thymic asthma.*

The actual condition of the larynx during a paroxysm is a spasm of the adductors, but the precise nature of the influences causing it is not yet known, whether centric or reflex from peripheral irritation. The disease is not so common in America as in England.

Symptoms.—The attacks may come on either in the night or in the day; often just as the child awakes. There is no cough, no hoarseness, but the respiration is arrested and the child struggles for breath, the face gets congested, and then, with a sudden relaxation of the spasm, the air is drawn into the lungs with a high-pitched crowing sound, which has given to the affection the name of "child-crowing." Convulsions may occur during an attack or there may be carpo-pedal spasms. Death may, but rarely does, occur during the attack. With the cyanosis the spasm relaxes and respiration begins. The attacks may recur with great frequency throughout the day.

Treatment.—The gums should be carefully examined and, if swollen and hot, freely lanced. The bowels should be carefully regulated and as these children are usually delicate or rickety nourishing diet and cod-liver oil should be given. By far the most satisfactory method of treatment is the cold sponging. In severe cases, two or three times a day the child should be placed in a warm bath and the back and chest thoroughly sponged for a minute or two with cold water. Since learning this practice from Ringer, at the University Hospital, I have seen many cases in which it proved successful. It may be employed when the child is in

Hysterical spasm — fatal cases in
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a paroxysm, though if the attack is severe and the lividity is great it is much better to dash cold water into the face. Sometimes the introduction of the finger far back into the throat will relieve the spasm.

Spasmodic croup, believed to be a functional spasm of the muscles of the larynx, is an affection seen most commonly between the the ages of two and five years. According to Trousseau's description, the child goes to bed well, and about midnight or in the early morning hours awakes with oppressed breathing, harsh, croupy cough, and perhaps some huskiness of voice. The oppression and distress for a time are very serious, the face is congested, and there are signs of approaching cyanosis. The attack passes off abruptly, the child falls asleep and awakes the next morning feeling perfectly well. These attacks may be repeated for several nights in succession, and usually cause great alarm to the parents. Whether this is entirely a functional spasm is, I think, doubtful. There are instances in which the child is somewhat hoarse through the day, and has slight catarrhal symptoms and a brazen, croupy cough. There is probably slight catarrhal laryngitis with it. These cases are not infrequently mistaken for true croup, and parents are sometimes unnecessarily disturbed by the serious view which the physician takes of the case. Too often the poor child, deluged with drugs, is longer in recovering from the treatment than he would be from the disease. To allay the spasm a whiff of chloroform may be administered, which will in a few moments give relief, or the child may be placed in a hot bath. A prompt emetic, such as zinc or wine of ipecac, will usually relieve the spasm, and is specially indicated if the child has overloaded the stomach through the day.

VI. TUBERCULOUS LARYNGITIS.

Etiology.—Tubercles may develop primarily in the laryngeal mucosa, but in the great majority of cases the affection is secondary to pulmonary tuberculosis, in which it is met with in a variable proportion of from eighteen to thirty per cent. Males are more frequently affected than females, possibly, as Bosworth suggested, because they are more frequently subject to catarrhal laryngitis, which is undoubtedly a predisposing cause. Laryngitis may occur very early in pulmonary tuberculosis. There may be well-marked involvement of the larynx with signs of very limited trouble at one apex. These are cases which, in my experience, run a very unfavorable course.

Morbid Anatomy.—The mucosa is at first swollen and presents scattered tubercles, which seem to begin in the neighborhood of the blood-vessels. By their fusion small tuberculous masses arise, which caseate and finally ulcerate, leaving shallow irregular losses of substance. The ulcers are usually covered with a grayish exudation, and there is a general thickening of the mucosa about them, which is particularly marked upon the

arytenoids. The ulcers may erode the true cords and finally destroy them, and passing deeply may cause perichondritis with necrosis and occasionally exfoliation of the cartilages. The disease may extend laterally and involve the pharynx, and downward over the mucous membrane covering the cricoid cartilage toward the œsophagus. Above, it may reach the posterior wall of the pharynx, and in rare cases extend to the fauces and tonsils. The epiglottis may be entirely destroyed. There are rare instances in which cicatricial changes go on to such a degree that stenosis of the larynx is induced, a remarkable specimen of which I saw some years ago with J. Solis-Cohen.

Symptoms.—The first indication is slight huskiness of the voice, which finally deepens to hoarseness, and in advanced stages there may be complete loss of voice. There is something very suggestive in the early hoarseness of tuberculous laryngitis. My attention has frequently been directed to the lungs simply by the quality of the voice.

The cough is in part due to involvement of the larynx. Early in the disease it is not very troublesome, but when the ulceration is extensive it becomes husky and ineffectual. Of the symptoms of laryngeal tuberculosis, none is more aggravating than the dysphagia, which is met with particularly when the epiglottis is involved, and when the ulceration has extended to the pharynx. There is no more distressing or painful complication in phthisis. In instances in which the epiglottis is in great part destroyed, with each attempt to take food there are distressing paroxysms of cough, and even of suffocation.

With the laryngoscope there is seen early in the disease a pallor of the mucous membrane, which also looks thickened and infiltrated, particularly that covering the arytenoid cartilages. The tuberculous ulcers are very characteristic. They are broad and shallow, with gray bases and ill-defined outlines. The vocal cords are infiltrated and thickened, and ulceration is very common.

The diagnosis of tuberculous laryngitis is rarely difficult, as it is usually associated with well-marked pulmonary disease. In case of doubt some of the secretion from the base of an ulcer should be removed and examined for bacilli.

Treatment.—Physicians pay scarcely sufficient attention to the laryngeal complications of consumption. The ulcers should be sprayed and kept thoroughly cleansed. Solutions of tannic acid, nitrate of silver, or sulphide of zinc may be employed. The insufflation, two or three times a day, of a powder of iodoform, with morphia, after thoroughly cleansing the ulcers with a spray, relieves the pain in a majority of the cases. Cocaine (four per cent solution) applied with the atomizer will often enable the patient to swallow his food comfortably. There are, however, distressing cases of extensive laryngeal and pharyngeal ulceration in which even cocaine loses its good effects. When the epiglottis is lost the difficulty in swallowing becomes very great. Wolfenden states that this may be obvi-

ated if the patient hangs his head over the side of the bed and sucks milk through a rubber tubing from a mug placed on the floor.

VII. SYPHILITIC LARYNGITIS.

Syphilis attacks the larynx with great frequency. It may result from the inherited disease or be a secondary or tertiary manifestation of the acquired form.

Symptoms.—In secondary syphilis there is occasionally erythema of the larynx, which may go on to definite catarrh, but has nothing characteristic. The process may proceed to the formation of superficial whitish ulcers, usually symmetrically placed on the cords or ventricular bands. Mucous patches and condylomata are rarely seen. The symptoms are practically those of slight loss of voice with laryngeal irritation, as in the simple catarrhal form.

The tertiary laryngeal lesions are numerous and very serious. True gummata, varying in size from the head of a pin to a small nut, develop in the submucous tissue most commonly at the base of the epiglottis. They go through the changes characteristic of these structures and may either break down, producing extensive and deep ulceration, or—and this is more characteristic of syphilitic laryngitis—in their healing form a fibrous tissue which shrinks and produces stenosis. The ulceration is apt to extend deeply and involve the cartilage, inducing necrosis and exfoliation, and even hæmorrhage from erosion of the arteries. Œdema may suddenly prove fatal. The cicatrices which follow the sclerosis of the gummata or the healing of the ulcers produce great deformity. The epiglottis, for instance, may be tied down to the pharyngeal wall or to the epiglottic folds, or even to the tongue; and eventually a stenosis results, which may necessitate tracheotomy.

The laryngeal symptoms of inherited syphilis have the usual course of these lesions and appear either early, within the first five or six months, or after puberty; most commonly in the former period. Of 76 cases, J. N. Mackenzie found that 63 occurred within the first year. The gummatous infiltration leads to ulceration, most commonly of the epiglottis and in the ventricles, and the process may extend deeply and involve the cartilage. Cicatricial contraction may also occur.

The diagnosis of syphilis of the larynx is rarely difficult, since it occurs most commonly in connection with other symptoms of the disease. For special details the manuals of laryngology should be consulted.

Treatment.—The administration of constitutional remedies is the most important, and under mercury and iodide of potassium the local symptoms may rapidly be relieved. The tertiary laryngeal manifestations are always serious and difficult to treat. The deep ulceration is specially

hard to combat, and the cicatrization may necessitate tracheotomy, or the gradual dilatation, as practised by Schroetter.

III. DISEASES OF THE BRONCHI.

I. ACUTE BRONCHITIS.

Acute catarrhal inflammation of the bronchial mucous membrane is a very common disease, rarely serious in healthy adults, but very fatal in the old and in the young, owing to associated pulmonary complications. It is bilateral and affects either the larger and medium sized tubes or the smaller bronchi, in which case it is known as capillary bronchitis.

We shall speak only of the former, as the latter is part and parcel of broncho-pneumonia.

Etiology.—Acute bronchitis is a common sequence of catching cold, and is often nothing more than the extension downward of an ordinary coryza. It occurs most frequently in the changeable weather of early spring and late autumn. Its association with cold is well indicated by the popular expression "cold on the chest." It may prevail as an epidemic apart from influenza, of which it is an important feature.

Acute bronchitis is associated with many other affections, notably measles. It is by no means rare at the onset of typhoid fever and malaria. It is present also in asthma and whooping-cough. The bronchitis of Bright's disease, gout, and heart-disease is usually a chronic form. It attacks persons of all ages, but most frequently the young and the old. There are individuals who have a special disposition to bronchial catarrh, and the slightest exposure is apt to bring on an attack. Persons who live an out-of-door life are usually less subject to the disease than those who follow sedentary occupations.

The affection is probably microbic, though we have as yet no definite evidence upon this point.

Morbid Anatomy.—The mucous membrane of the trachea and bronchi is reddened, congested, and covered with mucus and muco-pus, which may be seen oozing from the smaller bronchi, some of which are dilated. The finer changes in the mucosa consist in desquamation of the ciliated epithelium, swelling and œdema of the submucosa, and infiltration of the tissue with leucocytes. The mucous glands are much swollen.

Symptoms.—The symptoms of an ordinary "cold" accompany the onset of an acute bronchitis. The coryza extends to the tubes, and may also affect the larynx, producing hoarseness, which in many cases is marked. A chill is rare, but there is invariably a sense of oppression, with heaviness and languor and pains in the bones and back. In mild cases there is scarcely any fever, but in severer forms the range is from 101° to 103°.

The bronchial symptoms set in with a feeling of tightness and rawness beneath the sternum and a sensation of oppression in the chest. The cough is rough at first, cutting and sore, and often of a ringing character. It comes on in paroxysms which rack and distress the patient extremely. During the severe spells the pain may be very intense beneath the sternum and along the attachments of the diaphragm. At first the cough is dry, but in a few days the secretion becomes muco-purulent and abundant, and finally purulent. With the loosening of the cough great relief is experienced. The sputum is made up largely of pus-cells, with a variable number of the large round alveolar cells, many of which contain carbon grains, while others have undergone the myelin degeneration.

Physical Signs.—The respiratory movements are not greatly increased in frequency unless the fever is high. There are instances, however, in which the breathing is rapid and when the smaller tubes are involved there is dyspnœa. On palpation the bronchial fremitus may often be felt. On auscultation in the early stage, piping sibilant râles are everywhere to be heard. They are very changeable, and appear and disappear with coughing. With the relaxation of the bronchial membranes and the greater abundance of the secretion, the râles change and become mucous and bubbling in quality.

The *course* of the disease depends on the conditions under which it develops. In healthy adults, by the end of a week the fever subsides and the cough loosens. In another week or ten days convalescence is fully established. In young children the chief risk is in the extension of the process downward. In measles and whooping-cough, the ordinary bronchial catarrh is very apt to descend to the finer tubes, which become dilated and plugged with muco-pus, inducing areas of collapse, and finally broncho-pneumonia. This extension is indicated by changes in the physical signs. Usually at the base the râles are subcrepitant and numerous and there may be areas of defective resonance and of feeble or distant tubular breathing. In the aged and debilitated there are similar dangers if the process extends from the larger to the smaller tubes. In old age the bronchial mucosa is less capable of expelling the mucus, which is more apt to sag to the dependent parts and induce dilatation of the tubes with extension of the inflammation to the contiguous air-cells.

The *diagnosis* of acute bronchitis is rarely difficult. Although the mode of onset may be brusque and perhaps simulate pneumonia, yet the absence of dulness and blowing breathing, and the general character of the bronchial inflammation, renders the diagnosis simple. The complication of broncho-pneumonia is indicated by the greater severity of the symptoms, particularly the dyspnœa, the defective color, and the physical signs.

Treatment.—In mild cases, household measures suffice. The hot foot-bath, or the warm bath, a drink of hot lemonade, and a mustard plaster on the chest will often give relief. For the dry, racking cough, the symptom most complained of by the patient, Dover's powder is the best

remedy. It is a popular belief that quinine, in full doses, will check an oncoming cold in the chest, but this is doubtful. It is a common custom when persons feel the approach of a cold to take a Turkish bath, and though the tightness and oppression may be relieved by it, there is in a majority of the cases great risk. Some of the severest cases of bronchitis which I have seen have followed this initial Turkish bath. No doubt, if the person could go to bed directly from the bath, its action would be beneficial, but there is great risk of catching additional "cold" in going home from the bath. Relief is obtained from the unpleasant sense of rawness by keeping the air of the room saturated with moisture, and in this dry stage the old-fashioned mixture of the wines of antimony and ipecacuanha with liquor ammoniæ acetatis and nitrous ether is useful. If the pulse is very rapid, tincture of aconite may be given, particularly in the case of children. For the cough, when dry and irritating, opium should be freely used in the form of Dover's powder. Of course, in the very young and the aged care must be exercised in the use of opium, particularly if the secretions are free; but for the distressing, irritative cough, which keeps the patient awake, no remedy can take its place As the cough loosens and the expectoration is more abundant, the patient becomes more comfortable. In this stage it is customary to ply the patient with expectorants of various sorts. Though useful occasionally, they should not be given as a matter of routine. A mixture of squills, ammonia, and senega is a favorite one with many practitioners at this stage.

In the acute bronchitis of children, if the amount of secretion is large and difficult to expectorate, or if there is dyspnœa and the color begins to get dusky, an emetic (a tablespoonful of ipecac wine) should be given at once and repeated if necessary.

II. CHRONIC BRONCHITIS.

Etiology.—This affection may follow repeated attacks of acute bronchitis, but it is most commonly met with in chronic lung affections, heart-disease, gout, and renal disease. It is frequent in the aged; the young rarely are affected. Climate and season have an important influence. It is the winter cough of the old man, which recurs with regularity as the weather gets cold and changeable.

Morbid Anatomy.—The bronchial mucosa presents a great variety of changes, depending somewhat upon the disease with which chronic bronchitis is associated. In some cases the mucous membrane is very thin, so that the longitudinal bands of elastic tissue stand out prominently. The tubes are dilated and the muscular and glandular tissues are atrophied and the epithelium in great part shed.

In other instances the mucosa is thickened, granular, and infiltrated. There may be ulceration, particularly of the mucous follicles. Bronchial

dilatations are not uncommon and emphysema is a constant accompaniment.

Symptoms.—In the form met with in old men, associated with emphysema, gout, or heart-disease, the chief symptoms are as follows: Shortness of breath, which may not be noticeable except on exertion. The patients "puff and blow" on going up hill or up a flight of stairs. This is due not so much to the chronic bronchitis itself as to associated emphysema or even to cardiac weakness. They complain of no pain. The cough is variable, changing with the weather and with the season. During the summer they may remain free, but each succeeding winter the cough comes on with severity and persists. There may be only a spell in the morning, or the chief distress is at night. The sputum in chronic bronchitis is very variable. In cases of the so-called dry catarrh there is no expectoration. Usually, however, it is abundant, muco-purulent, or distinctly purulent in character. There are instances in which the patient coughs up for years a thin fluid sputum. There is rarely fever. The general health may be good and the disease may present no serious features apart from the liability to induce emphysema and bronchiectasy. In many cases it is an incurable affection. Patients improve and the cough disappears in the summer time only to return during the winter months.

Physical Signs.—The chest is usually distended, the movements are limited, and the condition is often that which we see in emphysema. The percussion note is clear or hyperresonant. On auscultation, expiration is prolonged and wheezy and rhonchi of various sorts are heard—some high-pitched and piping, others deep-toned and snoring. Crepitation is common at the bases.

Clinical Varieties.—The description just given is of the ordinary chronic bronchitis which occurs in connection with emphysema and heart-disease and in many elderly men. There are certain forms which merit special description: (*a*) On several occasions I have met with a form of *chronic bronchitis*, particularly in women, which comes on between the ages of twenty and thirty and may continue indefinitely without serious impairment of the health. In one case, a lady of fifty, with a phthisical family history, began to cough when she was twenty-five, and since then has had more or less cough every day without intermission. It has not seriously impaired her health, though she has never been strong. Once or twice she has had attacks of eczema. The cough is chiefly in the morning, is apt to be brought on by too much conversation, and is quite independent of the weather. The daily amount of expectoration is not great, rarely more than from four to six ounces. It is muco-purulent in character. The examination of the chest is negative—no emphysema, no râles. I have met several such instances which seem to form a type of chronic bronchitis, though it is difficult to say upon what the condition depends.

(*b*) *Bronchorrhœa.*—Excessive bronchial secretion is met with under several conditions. It must not be mistaken for the profuse expectoration

of bronchiectasy. The secretion may be very liquid and watery—*bronchorrhœa serosa.* More commonly, it is purulent though thin, and with greenish or yellow-green masses. It may be thick and uniform. This profuse bronchial secretion is usually a manifestation of chronic bronchitis and may lead to dilatation of the tubes and ultimately to fetid bronchitis. In the young the condition may persist for years without impairment of health and without apparently damaging the lungs.

(*c*) *Putrid Bronchitis.*—Fetid expectoration is met with in connection with bronchiectasis, gangrene, abscess, or with decomposition of secretions within phthisical cavities and in an empyema which has perforated the lung. There are instances in which, apart from any of these states, the expectoration has a fetid character. The sputa are abundant, usually thin, grayish white in color, and they separate into an upper fluid layer capped with frothy mucus and a thick sediment in which may sometimes be found dirty yellow masses the size of peas or beans—the so-called Dittrich's plugs. The affection is very rare apart from the above-mentioned conditions. In severe cases it leads to changes in the bronchial walls, pneumonia, and often to abscess or gangrene. Metastatic brain abscess has followed putrid bronchitis in a certain number of cases.

(*d*) *Dry Catarrh.—Catarrhe sec* of Laennec is a not uncommon form, characterized by paroxysms of coughing of great intensity, with little or no expectoration. It is usually met with in elderly persons with emphysema, and is one of the most chronic and obstinate of all varieties of bronchitis.

Treatment.—By far the most satisfactory method of treating the recurring winter bronchitis is change of climate. Removal to a southern latitude may prevent the onset. Southern France, southern California, and Florida furnish winter climates in which the subjects of chronic bronchitis live with the greatest comfort. All cases of prolonged bronchial irritation are benefited by change of air.

The first endeavor in treating a case of chronic bronchitis is to ascertain if possible whether there are constitutional or local affections with which it is associated. In many instances the urine is found to be highly acid, perhaps slightly albuminous, and the arteries are stiff. In the form associated with this condition, sometimes called gouty bronchitis, the attacks seem related to the defective renal elimination, and to this condition the treatment should be first directed. In other instances there are heart-disease and emphysema. In the form occurring in old men much may be done in the way of prophylaxis. Septuagenarians should read Oliver Wendell Holmes's * "De Senectute" with reference to the care of the health and the avoidance of catching cold. He lays stress upon the importance of the daily study of the thermometer and barometer. There is no doubt that with prudence even in our changeable winter weather much may be

* Over the Tea-cups, Boston, 1890.

III. BRONCHIECTASIS.

Etiology.—Dilatation of the bronchi occurs under the following conditions: (1) As a congenital defect or anomaly. Such cases are extremely rare, commonly unilateral. Grawitz has described the condition as *bronchiectasia universalis*. Welch has met an instance in a young child. (2) In connection with inflammation of the bronchi, particularly those that leads to weakness of the walls with the accumulation of secretion. Under this category come the dilatation met with in chronic bronchitis and emphysema, the dilated bronchi in chronic phthisis, in the interstitial pneumonia of children, and particularly the dilitation which results from the presence of foreign bodies in the air-tubes or from pressure, as of an aneurism on one bronchus. (3) In extreme contraction of the lung tissue, whether due to interstitial pneumonia or to compression by pleural adhesions, bronchial dilatation is a common though not a constant accompaniment.

Unquestionably the weakening of the bronchial wall is the most important, probably the essential, factor in inducing bronchiectasy, since the wall is then not able to resist the pressure of air in severe spells of coughing and straining. In some instances the mere weight of the accumulated secretion may be sufficient to distend the terminal tubules, as is seen in compression of a bronchus by aneurism.

Morbid Anatomy.—Two chief forms are recognized—the *cylindroid* and the *saccular*—which may exist together in the same lung. The

Dr Brewer. says this seems

strong. Look up. 60-80

done to prevent the onset of chronic bronchitis. Woolen undergarments should be used and especial care should be taken in the spring months not to change them for lighter ones before the warm weather is established.

Cure is seldom effected by medicinal remedies. There are instances in which iodide of potassium acts with remarkable benefit, and it should always be given a trial in cases of paroxysmal bronchitis of obscure origin. When the secretion is excessive the muriate of ammonia is perhaps the most useful. Stimulating expectorants are contra-indicated. When the heart is feeble, the combination of digitalis and strychnia is very beneficial. Turpentine, the old-fashioned remedy so warmly recommended by the Dublin physicians, has in many quarters fallen undeservedly into disuse. Terebene in capsules is a useful substitute because it is more easily taken. Of other balsamic remedies, sandalwood, the compound tincture of benzoin, copaiba, balsam of Peru or tolu may be used. Inhalations are often very useful. If fetor be present, carbolic acid in the form of spray (~~twenty~~ to ~~thirty~~ per cent solution) will lessen the odor, or thymol (1 to 1,000). In full-blooded men, when venous engorgement exists and shortness of breath, the abstraction of twenty to thirty ounces of blood will afford prompt relief.

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condition may be general or partial. Universal bronchiectasis is always unilateral. It occurs in rare congenital cases and is occasionally seen as a sequence of interstitial pneumonia. The entire bronchial tree is represented by a series of sacculi opening one into the other. The walls are smooth and possibly without ulceration or erosion except in the dependent parts. The lining membrane of the sacculi is usually smooth and glistening. The dilatations may form large cysts immediately beneath the pleura. Intervening between the sacculi is a dense cirrhotic lung tissue. The partial dilatations—the saccular and cylindrical—are common in chronic phthisis, particularly at the apex, in chronic pleurisy at the base, and in emphysema. Here the dilatation is more commonly cylindrical, sometimes fusiform. The bronchial mucous membrane is much involved and sometimes there is a narrowing of the lumen. Occasionally one meets with a single saccular bronchiectasy in connection with chronic bronchitis or emphysema. Some of these look like simple cysts, with smooth walls, without fluid contents.

Histologically the bronchi which are the seat of dilatation show important changes. In the large, smooth dilatations the cylindrical is replaced by a pavement epithelium. The muscular layer is stretched, atrophied, and the fibres separated; the elastic tissue is also much stretched and separated. In the large saccular bronchiectasies and in some of the cylindrical forms, due to retained secretions, the lining membrane is ulcerated. The contents of some of the larger bronchiectatic cavities are horribly fetid.

Symptoms.—In the limited dilatations of phthisis, emphysema, and chronic bronchitis, the symptoms are in great part those of the original disease, and the condition often is not suspected during life.

In extensive saccular bronchiectasy the characters of the cough and expectoration are distinctive. The patient will pass the greater part of the day without any cough and then in a severe paroxysm will bring up a large quantity of sputum. Sometimes change of the position will bring on a violent attack, probably due to the fact that some of the secretion flows from the dilatation to a normal tube. The daily spell of coughing is usually in the morning. The expectoration is in many instances very characteristic. It is grayish or grayish brown in color, fluid, purulent, with a peculiar acid, sometimes fetid, odor. Placed in a conical glass, it separates into a thick granular layer below and a thin mucoid intervening layer above, which is capped by a brownish froth. Microscopically it consists of pus-corpuscles, often large crystals of fatty acids, which are sometimes in enormous numbers over the field and arranged in bunches. Hæmatoidin crystals are sometimes present. Elastic fibres are seldom found except when there is ulceration of the bronchial walls. Tubercle bacilli are not present. In some cases the expectoration is very fetid and has all the characters of those described under fetid bronchitis. Nummular expectoration, such as comes from phthisical cavities, is not

common. Hæmorrhage may occur, but in my experience it has been rare. Abscess of the brain has in a few instances followed the bronchiectasis. Rheumatoid affections may develop (Gerhardt).

The *diagnosis* is not possible in a large number of the cases. In the extensive sacculated forms, unilateral and associated with interstitial pneumonia or chronic pleurisy, the diagnosis is easy. There is contraction of the side, which in some instances is not at all extreme. The cavernous signs may be chiefly at the base and may vary according to the condition of the cavity, whether full or empty. There may be the most exquisite amphoric phenomena and loud resonant râles. The condition persists for years and is not inconsistent with tolerably active life. The patients frequently show signs of marked embarrassment of the pulmonary circulation. There is cyanosis on exertion, the finger-tips are clubbed, and the nails incurved. A condition very difficult to distinguish from bronchiectasy is a limited pleural cavity communicating with a bronchus.

Treatment.—Medical treatment is not satisfactory, since it is impossible to heal the cavity. I have practised the injection of antiseptic fluids in some instances with benefit. In suitable cases drainage of the cavities may be attempted, particularly if the patient is in fairly good condition. For the fetid secretion turpentine may be given or terebene, and inhalations used of carbolic acid or thymol. In extreme cases it is very difficult to get rid of the offensive odor.

IV. BRONCHIAL ASTHMA.

Asthma is a term which has been applied to various conditions associated with dyspnœa—hence the names cardiac and renal asthma—but its use should be limited to the affection known as bronchial or spasmodic asthma.

Etiology.—All writers agree that there is in a majority of cases of bronchial asthma a strong neurotic element. Many regard it as a neurosis in which, according to one view, spasm of the bronchial muscles, according to the other, turgescence of the mucosa, results from disturbed innervation, pneumogastric or vaso-motor. Of the numerous theories the following are the most important:

(1) That it is due to spasm of the bronchial muscles, a theory which has perhaps the largest number of adherents. The original experiments of C. J. B. Williams, upon which it is largely based, have not, however, been confirmed of late years.

(2) That the attack is due to swelling of the bronchial mucous membrane—fluctionary hyperæmia (Traube), vaso-motor turgescence (Weber), diffuse hyperæmic swelling (Clark).

(3) That in many cases it is a special form of inflammation of the smaller bronchioles—*bronchiolitis exudativa* (Curschmann). Other theo-

ries which may be mentioned are that the attack depends on spasm of the diaphragm or on reflex spasm of all the inspiratory muscles.

As already mentioned, the so-called hay fever is an affection which has many resemblances to bronchial asthma, with which the attacks may alternate. In the suddenness of onset and in many of their features these diseases have the same origin and differ only in site, as suggested by Sir Andrew Clark and now generally acknowledged by specialists. Making due allowance for anatomical differences, if the structural changes occurring in the nasal mucous membrane during an attack of hay fever were to occur also in various parts of the bronchial mucosa, their presence there would afford a complete and adequate explanation of the facts observed during a paroxysm of bronchial asthma (Clark). With this statement I fully agree, but the observations of Curschmann have directed attention to a feature in asthma which has been neglected; namely, that in a majority of the cases it is associated with an exudation, such as might be supposed to come from a turgescent mucosa and which is of a very characteristic and peculiar character. The hyperæmia and swelling of the mucosa and the extremely viscid, tenacious mucus explain well the hindrance to inspiration and expiration and also the quality of the râles.

Some general facts with reference to etiology may be mentioned. The affection sometimes runs in families, particularly those with irritable and unstable nervous systems. The attack may be associated with neuralgia or, as Salter mentions, even alternate with epilepsy. Men are more frequently affected than women. The disease often begins in childhood and sometimes lasts until old age. One of its most striking peculiarities is the *bizarre* and extraordinary variety of circumstances which at times induce a paroxysm. Among these local conditions climate or atmosphere are most important. A person may be free in the city and invariably suffer from an attack when he goes into the country, or into one special part of the country. Such cases are by no means uncommon. Breathing the air of a particular room or a dusty atmosphere may bring on an attack. Odors, particularly of flowers and of hay, or emanations from animals, as the horse, dog, or cat, may at once cause an outbreak. Fright or violent emotion of any sort may bring on a paroxysm. Uterine and ovarian troubles were formerly thought to induce attacks and may do so in rare instances. Diet, too, has an important influence, and in persons subject to the disease severe paroxysms may be induced by overloading the stomach, or by taking certain articles of food. Chronic cases, in which the attacks recur year after year, gradually become associated with emphysema, and every fresh "cold" induces a paroxysm. And lastly, many cases of bronchial asthma are associated with affections of the nose, particularly with hypertrophic rhinitis and nasal polypi. According to some specialists of large experience, all cases of bronchial asthma have some affection of the upper air-passages, but I am convinced from personal observation that this is erroneous. Still physicians must acknowledge the debt which we

owe to Voltolini, Hack, Daly, Roe, and others who have shown the close connection which exists between affections of the nose and many cases of bronchial asthma.

Briefly stated then, bronchial asthma is a neurotic affection, characterized by hyperæmia and turgescence of the mucosa of the smaller bronchial tubes and a peculiar exudate of mucin. The attacks may be due to direct irritation of the bronchial mucosa or may be induced reflexly, by irritation of the nasal mucosa, and indirectly, too, by reflex influences, from stomach, intestines, or genital organs.

Symptoms.—Premonitory sensations precede some attacks, such as chilly feeling, a sense of tightness in the chest, flatulence, passage of a large quantity of urine, or great depression of spirits. Nocturnal attacks are common. After a few hours' sleep, the patient is aroused with a distressing sense of want of breath and a feeling of great oppression in the chest. Soon the respiratory efforts become violent, all the accessory muscles are brought into play, and in a few minutes the patient is in a paroxysm of the most intense dyspnœa. The face is pale, the expression anxious, speech is impossible, and in spite of the most strenuous inspiratory efforts very little air enters the lungs. Expiration is prolonged and also wheezy. The number of respirations, however, is not much increased. The asthmatic fit may last from a few minutes to several hours. When severe, the signs of defective aëration soon appear, the face becomes bedewed with sweat, the pulse is small and quick, the extremities get cold, and just as the patient seems to be at his worst, the breathing begins to get easier, and often with a paroxysm of coughing relief is obtained and he sinks exhausted to sleep. The relief may be but temporary and a second attack may soon come on. In a majority of the cases even in the intervals between the asthmatic fits the respiration is somewhat embarrassed. The cough is at first very tight and dry and the expectoration is expelled with the greatest difficulty.

The physical signs during an attack are very characteristic. On inspection the thorax looks enlarged, barrel-shaped, and is fixed, the amount of expansion being altogether disproportionate to the intensity of the inspiratory movements. The diaphragm is lowered and moves but slightly. Inspiration is short and quick, expiration prolonged. Percussion may not reveal any special difference, but there is sometimes marked hyperresonance, particularly in cases which have had repeated attacks.

On auscultation, with inspiration and expiration, there are innumerable sibilant and sonorous râles of all varieties, piping and high-pitched, low-pitched and grave. Later in the attack there are moist râles.

The *sputum* in bronchial asthma is quite distinctive, unlike that which occurs in any other affection. Early in the attack it is brought up with great difficulty and is in the form of rounded gelatinous masses, the so-called "*perles*" of Laennec. Though ball-like, they can be unfolded and really represent moulds in mucus of the smaller tubes. The entire expec-

toration may be made up of these somewhat translucent-looking pellets, floating in a small quantity of thin mucus. Some of them are opaque. Often with the naked eye a twisted spiral character can be seen, particularly if the sputum is spread on a glass with a black background. Microscopically, many of these pellets have a spiral structure, which renders them among the most remarkable bodies met with in sputum. It is not a little curious that they should have been practically overlooked until described a few years ago by Curschmann. Under the microscope the spirals are of two forms. In one there is simply a twisted, spirally arranged mucin, in which are entangled cells, derived probably from the smaller bronchi and alveoli, often in all stages of fatty degeneration. The twist may be loose or tight. The second form is much more peculiar. In the centre of a tightly coiled skein of mucin fibrils with a few scattered cells is a filament of extraordinary clearness and translucency, probably composed of transformed mucin. As Curschmann suggests, these spirals are doubtless formed in the finer bronchioles and constitute the product of an acute bronchiolitis. It is difficult to explain their spiral nature. I do not know of any observations upon the course of the currents produced by the ciliated epithelium in the bronchi, but it is quite possible that their action may be rotatory, in which case, particularly when combined with spasm of the bronchial muscles, it is possible to conceive that the mucus formed in the tube might be compelled to assume a spiral form. Within two or three days the sputum changes entirely in character; it becomes muco-purulent and Curschmann's spirals are no longer to be found. They occur in all instances of true bronchial asthma in the early period of the attack. There are, in addition, in many cases, the pointed, octahedral crystals described by Leyden and sometimes called asthma crystals. They are identical with the crystals found in the semen and in the blood in leukæmia. At one time they were supposed, by their irritating character, to induce the paroxysms.

The *course* of the disease is very variable. In severe attacks the paroxysms recur for three or four nights or even more, and in the intervals and during the day there may be wheezing and cough. Early in the disease the patient may be free in the morning, without cough or much distress, and the attacks may appear at first to be of a purely nervous character. In the long-standing cases emphysema almost invariably develops, and while the pure asthmatic fits diminish in frequency the chronic bronchitis and shortness of breath become aggravated.

We have no knowledge of the morbid anatomy of true asthma. Death during the attack is unknown. In long-standing cases the lesions are those of chronic bronchitis and emphysema.

Treatment.—The asthmatic attack usually demands immediate and prompt treatment, and remedies should be administered which experience has shown are capable of relieving the condition of the bronchial mucosa. A few whiffs of chloroform will produce prompt though temporary relaxa-

tion. In a child with very severe attacks, resisting all the usual remedies, the treatment by chloroform gave immediate and finally permanent relief. Perles of nitrite of amyl may be broken on the handkerchief or from two to five drops of the solution may be placed upon cotton-wool and inhaled. Strong stimulants given hot or a dose of spirits of chloroform in hot whisky will sometimes induce relaxation. More permanent relief is given by the hypodermic injection of morphia or of morphia and cocaine combined. In obstinate and repeatedly recurring attacks this has proved a very satisfactory plan. The sedative antispasmodics, such as belladonna, henbane, stramonium, and lobelia, may be given in solution or used in the form of cigarettes. Nearly all the popular remedies either in this form or in pastilles contain some of the plant of the order *solanaceæ*, with nitrate or chlorate of potash. Excellent cigarettes are now manufactured and asthmatics try various sorts, since one form benefits one patient, another form another patient. Nitre paper made with a strong solution of nitrate of potash is very serviceable. Filling a room with the fumes of this paper prior to retiring will sometimes ward off a nocturnal attack. I have known several patients to whom tobacco smoke inhaled was quite as potent as the prepared cigarettes.

The use of compressed air in the pneumatic cabinet is very beneficial; oxygen inhalations may be also tried. In preventing the recurrence of the attacks there is no remedy so useful as iodide of potassium, which sometimes acts like a specific. From ten to twenty grains three times a day is usually sufficient.

Particular attention should be paid to the diet of asthmatic patients. A rule which experience generally compels them to make is to take the heavy meals in the early part of the day and not retire to bed before gastric digestion is completed. As the attacks are often induced by flatulency, the carbohydrates should not be allowed. Coffee is a more suitable drink than tea. In respect to climate it is very difficult to lay down rules for asthmatics. The patients are often much better in the city than in the country. The high and dry altitudes are certainly more beneficial than the sea-shore; but in protracted cases, with emphysema as a secondary complication, the rarefied air of high altitudes is not advantageous. In young persons I have known a residence for six months in Florida or southern California to be followed by prolonged freedom from attacks.

V. FIBRINOUS BRONCHITIS.

An acute or chronic affection, characterized by the formation in certain of the bronchial tubes of fibrinous casts, which are expelled in paroxysms of dyspnœa and cough.

In several diseases fibrinous moulds of the bronchi are formed, as in diphtheria and croup (with extension into the trachea and bronchi), in

pneumonia, and occasionally in phthisis—conditions which, however, have nothing to do with true fibrinous bronchitis. These casts are not to be confounded with the blood-casts which occur occasionally in hæmoptysis.

Etiology.—Nothing is known of its causation. It occurs more frequently in males. It is met with at all periods of life, but is more common between the ages of twenty and forty. It has been known to attack several members of the same family. Cases have been described occurring together as if due to some endemic influence (Pichini). The cases are rare, particularly in hospital practice. The attacks occur most commonly in the spring months. An association with tuberculosis has been frequently noted. Model, in an article from Bäumler's clinic, states that tuberculosis was present in ten of twenty-one post-mortems. It has been met with also in connection with skin-diseases, such as pemphigus, impetigo, and herpes. The attacks appeared to be related in some cases to the menstrual period. Several instances have been described with heart-disease, but it seems probable that in all these conditions the connection was not causal.

Symptoms.—Acute cases are rare. They may set in with high fevers, rigors, severe paroxysms of cough, and perhaps with hæmoptysis. The clinical picture resembles acute bronchitis, and only the expulsion of the membranous casts gives the characteristic features to the case. It is much more serious than the chronic form and fatal termination is not uncommon. N. S. Davis has reported two fatal cases. In some of the acute cases there has been affection of the tonsils, and it is possible that the disease may have been truly diphtheritic in character and due to extension of the membrane into the trachea and bronchi. The casts in these cases are not only more extensive, but they also do not present the laminated structure characteristic of true plastic bronchitis.

A patient may have a single attack without any recurrence, but in the chronic form the attacks come on at varying intervals and the disease may last for ten or even twenty years. Instances are on record in which the paroxysms have occurred at definite intervals for many months. The attacks may recur weekly or a period of a year or more may intervene. The onset is marked by bronchitic symptoms, not necessarily with fever. The cough becomes distressing and paroxysmal in character; the sputa may be blood-stained and the patient brings up rounded, ball-like masses, which, when disentangled, are found to be moulds of bronchi; the hæmorrhage may be profuse. In one of the two cases which I have seen it invariably accompanied the attack, and the whitish dendritic casts of the tubes were always entangled in the blood and clots. Urgent dyspnœa and cyanosis may be present in severe attacks. The *physical* signs are those of a severe bronchitis. It may occasionally be possible to determine the weakened or suppressed breath sounds in the affected territory and there may be deficient expansion or even retraction of the chest wall in a corresponding area, but this is in reality very difficult, and twice prior to the expulsion of the casts I failed to determine by physical examination the affected region.

As mentioned, the casts are usually rolled up and mixed with mucus or blood. When unravelled in water they present a complete mould of a secondary or tertiary bronchus with its ramifications. The size of the cast may vary with different attacks, but, as has often been noticed, the form and size may be identical at each attack as if precisely the same bronchial area was involved each time. The casts are hollow, laminated, the size of the lumen varying with the number and thickness of the laminæ. Sometimes they are almost solid. Transverse sections show a beautiful concentric arrangement. The fibrin appears in places to retain its fibrillary structure; in others, as in diphtheritic membrane, it has undergone the hyaline transformation. Leucocytes are imbedded in the meshes. In the centre, particularly in the smaller casts, it is not uncommon to see alveolar epithelium with numerous carbon particles. Leyden's crystals are sometimes found and occasionally Curschmann's spirals.

The pathology of the disease is obscure. The membrane is identical with that to which the term croupous is applied, and the obscurity relates not so much to the mechanism of the production, which is probably the same as in other mucous surfaces, as to the curious limitation of the affection to certain bronchial territories and the remarkable recurrence at stated or irregular intervals throughout a period of many years.

In the acute cases the *treatment* should be that of ordinary acute bronchitis. We know of nothing which can prevent the recurrence of the attacks in the chronic form. In the uncomplicated cases there is rarely any danger during the paroxysm, even though the symptoms may be most distressing and the dyspnœa and cough very severe. Inhalations of ether, steam, or atomized lime-water aid in the separation of the membranes. Pilocarpine might be useful, as in some instances it increases the bronchial secretion. The employment of emetics may be necessary, and in some cases they are effective in promoting the removal of the casts.

IV. DISEASES OF THE LUNGS.

I. CIRCULATORY DISTURBANCES IN THE LUNGS.

Congestion.—There are two forms of congestion of the lungs—active and passive.

(1) *Active Congestion of the Lungs.*—Much doubt and confusion still exist on this subject. French writers, following Woillez, regard it as an independent primary affection (*maladie de Woillez*), and in their dictionaries and text-books allot much space to it. English and American authors more correctly regard it as a symptomatic affection. Active fluxion to the lungs occurs with increased action of the heart, and when very hot air or irritating substances are inhaled. In diseases which interfere

locally with the circulation the capillaries in the adjacent unaffected portions may be greatly distended. The importance, however, of this collateral fluxion, as it is called, is probably exaggerated. In a whole series of pulmonary affections there is this associated congestion—in pneumonia, bronchitis, pleurisy, and tuberculosis.

The symptoms of active congestion of the lungs are by no means definite. The description given by Woillez and by other French writers is of an affection which is difficult to recognize from anomalous or larval forms of pneumonia. The chief symptoms described are initial chill, pain in the side, dyspnœa, moderate cough, and temperature from 101° to 103°. The physical signs are defective resonance, feeble breathing, sometimes bronchial in character, and fine râles. A majority of clinical physicians would undoubtedly class such cases under inflammation of the lung. In many epidemics the abnormal and larval forms are specially prevalent. This is no doubt the condition to which Porcher, of Charlestown, called attention a short time ago as a "hitherto undescribed affection of the lungs."

The occurrence of an intense and rapidly fatal congestion of the lung, following extreme heat or cold or sometimes violent exertion, is recognized by some authors. Renforth, the oarsman, is said to have died from this cause during the race at Halifax. Leuf has described cases in which, in association with drunkenness, exposure, and cold, death occurred suddenly, or within twenty-four hours, and the only lesion found has been an extreme, almost hæmorrhagic, congestion of the lungs. It is by no means certain that in these cases death really occurs from pulmonary congestion in the absence of specific statements with reference to the coronary arteries. Several times in sudden death from disease of these vessels I have seen great engorgement of the lungs though not the extreme grade mentioned by Leuf. I have no personal knowledge of cases such as he describes.

(2) *Passive Congestion.*—Two forms of this may be recognized, the mechanical and the hypostatic.

(*a*) Mechanical congestion occurs whenever there is an obstacle to the return of the blood to the heart. It is a common event in many affections of the left heart. The lungs are voluminous, russet brown in color, cutting and tearing with great resistance. On section they show at first a brownish-red tinge, and then the cut surface, exposed to the air, becomes rapidly of a vivid red color from oxidation of the abundant hæmoglobin. This is the condition known as *brown induration* of the lung. Histologically it is characterized by (α) great distention of the alveolar capillaries; (β) increase in the connective-tissue elements of the lung; (γ) the presence in the alveolar walls of many cells containing altered blood-pigment; (δ) in the alveoli numerous epithelial cells containing blood-pigment in all stages of alteration, which are also found in great numbers in the sputum.

It occasionally happens that this mechanical hyperæmia of the lung results from pressure of tumors. So long as compensation is maintained the mechanical congestion of the lung in heart-disease does not produce any symptoms, but with enfeebled heart action the engorgement becomes marked and there are dyspnœa, cough, and expectoration, with the characteristic alveolar cells.

(*b*) Hypostatic congestion. In fevers and adynamic states generally it is very common to find the bases of the lungs deeply congested, a condition induced partly by the effect of gravity, the patient lying recumbent in one posture for a long time, but chiefly by weakened heart action. That it is not an effect of gravity alone is shown by the fact that a healthy person may remain in bed an indefinite time without its occurrence. The term hypostatic congestion is applied to it. The posterior parts of the lung are dark in color and engorged with blood and serum; in some instances to such a degree that the alveoli no longer contain air and portions of the lung sink in water. The term *splenization* and hypostatic pneumonia have been given to these advanced grades. It is a common affection in protracted cases of typhoid fever and in long debilitating illnesses. In ascites, meteorism, and abdominal tumors the bases of the lungs may be compressed and congested. In this connection must be mentioned the form of passive congestion met with in injury to, and organic disease of, the brain. In cerebral apoplexy the bases of the lungs are deeply engorged, not quite airless, but heavy, and on section drip with blood and serum. I have twice seen this condition in an extreme grade throughout the lungs in death from morphia poisoning. In some instances the lung tissue has a blackish, gelatinous, infiltrated appearance, almost like diffuse pulmonary apoplexy. Occasionally this congestion is most marked in, and even confined to, the hemiplegic side. In prolonged coma the hypostatic congestion may be associated with patches of consolidation, due to the aspiration of portions of food into the air-passages.

The symptoms of hypostatic congestion are not at all characteristic, and the condition has to be sought for by careful examination of the bases of the lungs, when slight dulness, feeble, sometimes blowing, breathing and liquid râles can be detected.

The *treatment* of congestion of the lungs is usually that of the condition with which it is associated. In the intense pulmonary engorgement, which may possibly occur primarily, and which is met with in heart-disease and emphysema, free bleeding should be practised. From twenty to thirty ounces of blood should be taken from the arm, and if the blood does not flow freely and the condition of the patient is desperate, aspiration of the right auricle may be performed.

Œdema.—In all forms of intense congestion of the lungs there is a transudation of serum from the engorged capillaries chiefly into the air-cells, but also into the alveolar walls. Not only is it very frequent in congestion, but also with inflammation, with new growths, infarcts, and tuber-

cles. When limited to the neighborhood of an affected part, the name collateral œdema is sometimes applied to it. General œdema occurs under conditions very similar to those met with in congestion. It is very often, no doubt, a terminal event, occurring with the death agony. It is seen in typical form in the cachexias, in death from anæmia, also in chronic Bright's disease, disease of the heart, and cerebral affections.

The œdematous lung is heavy, looks watery, pits on pressure, and from the cut surface a large quantity of clear and, in cases of congestion, bloody serum flows freely; the tissue may even have a gelatinous, infiltrated appearance. The condition is much more common at the bases, but it may exist throughout the entire lung. The pathology of pulmonary œdema is not always clear. Two factors usually prevail in extreme cases—increased tension within the pulmonary system and a diluted blood plasma. The increased tension alone is not capable of producing it. The experiments of Welch seem to indicate that the essential factor lies in a disproportionate weakness of the left ventricle, so that the blood accumulates in the lung capillaries until transudation occurs, a view which satisfactorily explains certain cases, particularly the terminal œdemas.

The *symptoms* of œdema of the lungs are often only an aggravation of those already existing, and are due to the primary disease, whether cardiac, renal, or general. There are usually increasing dyspnœa and cough, and on examination there may be defective resonance and large liquid râles at the bases. There are cases in which the œdema comes on with great suddenness, and in chronic Bright's disease it may prove rapidly fatal.

In the cases of so-called inflammatory œdema fever is always present, and often signs, more or less marked, of pneumonia.

The *treatment* of œdema of the lung is practically that of the conditions with which it is associated. In the acute cases active catharsis, and, if there is cyanosis, free venesection should be resorted to.

Pulmonary Hæmorrhage.—This occurs in two forms—*broncho-pulmonary hæmorrhage*, sometimes called bronchorrhagia, in which the blood is poured out into the bronchi and is expectorated, and *pulmonary apoplexy* or pneumorrhagia, in which the hæmorrhage takes place into the air-cells and the lung tissue.

1. *Broncho-pulmonary Hæmorrhage; Hæmoptysis.*—Spitting of blood, to which the term hæmoptysis should be restricted, results from a variety of conditions, among which the following are the most important: (*a*) In young healthy persons hæmoptysis may occur without warning, and after continuing for a few days disappear and leave no ill traces. There may be at the time of the attack no physical signs indicating pulmonary disease. In such cases good health may be preserved for years and no further trouble occur. These cases are not very uncommon. In Ware's important contribution to this subject,* of 386 cases of hæmoptysis noted in

* On Hæmoptysis as a Symptom, by John Ware, M. D.

private practice 62 recovered and pulmonary disease did not subsequently develop in them. I know three professional men who had hæmoptysis as students, and who now, at periods of from fifteen to eighteen years subsequently, remain in perfect health. (*b*) Hæmoptysis in pulmonary tuberculosis. So frequently are these conditions associated that in the lay mind spitting of blood and consumption are almost synonymous. The Hippocratic aphorism, "From a spitting of blood there is a spitting of pus," is repeated throughout the literature of more than twenty centuries. It occurs either early in the disease, before there are any obvious physical signs, or after the development of well-marked local lesions. Unquestionably in a majority of the cases in which subsequent to hæmoptysis phthisis occurs tubercles were already present in the lung. The hæmorrhage is bronchial and associated with a limited focus of disease. When the pulmonary lesion is more advanced the hæmoptysis results either from erosion of a branch of the pulmonary artery or from rupture of an aneurismal dilatation of the same. (*c*) In connection with certain diseases of the lung, as pneumonia (in the initial stage) and cancer, occasionally in gangrene, abscess, and bronchiectasis, hæmoptysis occurs. (*d*) Hæmoptysis is met with in many heart affections, particularly mitral lesions. It may be profuse and recur at intervals for years. (*e*) In ulcerative affections of the larynx, trachea, or bronchi. Sometimes the hæmorrhage is profuse and rapidly fatal, as when an ulcer erodes a large branch of the pulmonary artery, an accident which I have known to happen in a case of chronic bronchitis with emphysema. (*f*) Aneurism is an occasional cause of hæmoptysis. It may be sudden and rapidly fatal when the sac bursts into the air-passages. Slight bleeding may continue for weeks or even longer, due to pressure on the mucous membrane, erosion of the lung, or in some cases the sac "weeps" through the exposed laminæ of fibrin. (*g*) Vicarious hæmorrhage, which occurs in rare instances in cases of interrupted menstruation. The instances are well authenticated. Flint mentions a case which he had had under observation for four years, and Hippocrates refers to it in the aphorism, "Hæmoptysis in a woman is removed by an eruption of the menses." Periodical hæmoptysis has also been met with after the removal of both ovaries. Even fatal hæmorrhage has occurred from the lung during menstruation when no lesion was found to account for it. (*h*) There is a form of recurring hæmoptysis in arthritic subjects to which Sir Andrew Clark has called special attention and which also is described by French writers. The cases occur in persons over fifty years of age who usually present signs of the arthritic diathesis. It rarely leads to fatal issue and subsides without inducing pulmonary changes. (*i*) Hæmoptysis recurs sometimes in malignant fevers and in purpura hæmorrhagica. Lastly, there is endemic hæmoptysis, due to the presence of the *Distoma Ringeri* in the bronchial tubes, an affection which is confined to parts of China and Japan.

Symptoms.—Hæmoptysis sets in as a rule suddenly. Often without warning the patient experiences a warm, saltish taste as the mouth

fills with blood. Coughing is usually induced. There may be only an ounce or so brought up before the bleeding stops, or the bleeding may continue for days, the patient bringing up small quantities. In other instances, particularly when a large vessel is eroded or an aneurism bursts, the amount is large, and the patient after a few attempts at coughing shows signs of suffocation and death is produced by inundation of the bronchial system. Fatal hæmorrhage may even occur into a large cavity in a patient debilitated by phthisis without the production of hæmoptysis. I dissected a case of this kind at the Philadelphia Hospital. The blood from the lungs generally has characters which render it readily distinguishable from the blood which is vomited. It is alkaline in reaction, frothy, and mixed with mucus, and when coagulation occurs air-bubbles are present in the clot. Blood-moulds of the smaller bronchi are sometimes seen. Patients can usually tell whether the blood has been brought up by coughing or by vomiting, and in a majority of cases the history gives important indications. In paroxysmal hæmoptysis connected with menstrual disturbances the practitioner should see that the blood is actually coughed up, since deception may be practised. Naturally, the patient is at first alarmed at the occurrence of bleeding, but, unless very profuse, as when due to rupture of an aortic aneurism in a pulmonary cavity, the danger is rarely immediate. The attacks, however, are apt to recur for a few days and the sputa may remain blood-tinged for a longer period. In the great majority of cases the hæmorrhage ceases spontaneously. It should be remembered that some of the blood may be swallowed and produce vomiting, and, after a day or two, the stools may be dark in color. It is not well during an attack of hæmoptysis to examine the chest. It was formerly thought that hæmorrhage exercised a prejudicial effect and excited inflammation of the lungs, but this is not often the case.

(2) *Pulmonary Apoplexy; Hæmorrhagic Infarct.*—In this condition the blood is effused into the air-cells and interstitial tissue. It is rarely indeed diffuse, breaking the parenchyma as the brain tissue is broken in cerebral apoplexy. Sometimes, in disease of the brain, in septic conditions, and in the malignant forms of fevers, the lung tissue is uniformly infiltrated with blood and has, on section, a black, gelatinous appearance.

As a rule, the hæmorrhage is limited and results from the blocking of a branch of the pulmonary artery either by a thrombus or an embolus. The condition is most common in chronic heart-disease. Although the pulmonary arteries are terminal ones, blocking is not always followed by infarction; partly because the wide capillaries furnish sufficient anastomosis, and partly because the bronchial vessels may keep up the circulation. The infarctions are chiefly at the periphery of the lung, usually wedge-shaped, with the base of the wedge toward the surface. When recent, they are dark in color, hard and firm, and look on section like an ordinary blood-clot. Gradual changes go on, and the color becomes a reddish brown. The pleura over an infarct is usually inflamed. A mi-

croscopical section shows the air-cells to be distended with red blood-corpuscles, which may also be in the alveolar walls. The infarcts are usually multiple and vary in size from a walnut to an orange. Very large ones may involve the greater part of a lobe. In the artery passing to the affected territory a thrombus or an embolus is found. The globular thrombi, formed in the right auricular appendix, play an important part in the production of hæmorrhagic infarction. In many cases the source of the embolus cannot be discovered, and the infarct may have resulted from thrombosis in the pulmonary artery, but, as before mentioned, it is not infrequent to find total obstruction of a large branch of a pulmonary artery without hæmorrhage into the corresponding lung area. The further history of an infarction is variable. It is possible that in some instances the circulation is re-established and the blood removed. More commonly, if the patient lives, the usual changes go on in the extravasated blood and ultimately a pigmented, puckered, fibroid patch results. Sloughing may occur with the formation of a cavity. Occasionally gangrene results. In a case at the University Hospital, Philadelphia, a gangrenous infarct ruptured and produced fatal pneumothorax.

The *symptoms* of pulmonary apoplexy are by no means definite. The condition may be suspected in chronic heart-disease when hæmoptysis occurs, particularly in mitral stenosis, but the bleeding may be due to the extreme engorgement. When the infarcts are very large, and particularly in the lower lobe, in which they most commonly occur, there may be signs of consolidation with blowing breathing.

Treatment of Pulmonary Hæmorrhage.—In the treatment of hæmoptysis it is important to remember the condition of the pulmonary circulation and the nature of the lesions associated with the hæmorrhage.

The pressure within the pulmonary artery is considerably less than that in the aortic system. We have as yet very imperfect knowledge of the circumstances which influence the lesser circulation in man. Researches, particularly those of Bradford, indicate that the system is under vasomotor control, but our knowledge of the mutual relations of pressure in the aorta and in the pulmonary artery, under varying conditions, is still very imperfect. Experiments with drugs seem to show that there may be an influence on systemic blood-pressure without any on the pulmonary, and the pressure in the one may rise while it falls in the other, or it may rise and fall in both together. In Andrew's Harveian Oration these relations are thoroughly described, and a statement is made, based on Bradford's experiments, as to the action on the pulmonary blood-pressure of many of the drugs employed in hæmoptysis. Thus ergot, the remedy perhaps most commonly used, causes a distinct rise in the pulmonary blood-pressure, while aconite produces a definite fall.

The anatomical condition in hæmoptysis is either hyperæmia of the bronchial mucosa (or of the lung tissue) or a perforated artery. In the

latter case the patient often passes rapidly beyond treatment, though there are instances of the most profuse hæmorrhage which must have come from a perforated artery or a ruptured aneurism in which recovery has occurred. Practically, for treatment, we should separate these cases, as the remedies which would be applicable in a case of congested and bleeding mucosa would be as much out of place in a case of hæmorrhage from ruptured aneurism as in a cut radial artery. When the blood is brought up in quantities—in mouthfuls at a time—it is almost certain either that an aneurism has ruptured or a vessel has been eroded. In the instances in which the sputa are blood-tinged or when the blood is in smaller quantities, bleeding comes by diapedesis from hyperæmic vessels. In such cases the hæmorrhage may be beneficial in relieving the congested blood-vessels.

The indications are to reduce the frequency of the heart-beats and to lower the blood-pressure. By far the most important measure is absolute quiet of body, such as can only be secured by rest in bed and seclusion. In the majority of cases of mild hæmoptysis this is sufficient. Even when the patient insists upon going about, the bleeding may stop spontaneously. The diet should be light and unstimulating. Alcohol should not be used. The patient may, if he wishes, have ice to suck. Small doses of aromatic sulphuric acid may be given, but unless the bleeding is protracted styptic and astringent medicines are not indicated. For cough, which is always present and disturbing, opium should be freely given, and is of all medicines most serviceable in hæmoptysis. Digitalis should not be used, as it raises the blood-pressure in the pulmonary artery. Aconite, as it lowers the pressure, may be used when there is much vascular excitement. Ergot, tannic acid, and lead, which are so much employed, have, I believe, little or no influence in hæmoptysis. Ergot, according to Bradford, produces distinct rise in the pulmonary blood-pressure. One of the most satisfactory means of lowering the blood-pressure is purgation, and when the bleeding is protracted salts may be freely given. In profuse hæmoptysis, such as comes from erosion of an artery or the rupture of an aneurism, a fatal result is common, and yet post-mortem evidence shows that thrombosis may occur with healing in a rupture of considerable size. The fainting induced by the loss of blood is probably the most efficient means of promoting thrombosis, and it was on this principle that formerly patients were bled from the arm, or from both arms, as in the case of Laurence Sterne. Ligatures, or Esmarch's bandages, placed around the legs may serve temporarily to check the bleeding. The ice-bag on the sternum is of doubtful utility. In a protracted case Cayley induced pneumothorax, but without effect.

Briefly, then, we may say that cases of hæmorrhage from rupture of aneurism or erosion of a blood-vessel usually prove fatal. The fainting induced by the loss of blood is beneficial, and, if the patient can be kept alive for twenty-four hours, a thrombus of sufficient strength to prevent further bleeding may form. The chief danger is the inundation of the

Huggard of Davos has recently practised it with success in plethoric phthisical subjects.

A Sickert Trafalgar.
B. R. W.

bronchial system with the blood, so that while the hæmorrhage is profuse the cough should be encouraged. Opium should not then be used, and stimulants should be given with caution.

In the other group, in which the hæmorrhage comes from a congested area and is limited, the patient gets well if kept absolutely quiet, and fatal hæmorrhage probably never occurs from this source. Rest, reduction of the blood-pressure by minimum diet, purging, if necessary, and the administration of opium to allay the cough are the main indications.

II. PNEUMONIA

(Lobar, Croupous, or Fibrinous Pneumonia; Pneumonitis; Lung Fever).

Definition.—An infectious disease characterized by inflammation of the lungs and constitutional disturbance of varying intensity. The fever terminates abruptly by crisis. Secondary infective processes are common An organism, the *diplococcus pneumoniæ*, is invariably found in the diseased lung.

Etiology.—Pneumonia is one of the most wide-spread of acute diseases. Hospital statistics show that the ratio to other admissions is in the proportion of twenty to thirty per thousand.

It prevails at all ages Children are quite as susceptible to it as adults, and it is the special enemy of old age. Males are more frequently affected than females. Dwellers in cities and persons whose occupations are associated with exposure, hardship, and cold are most liable to the disease. Contrary to the general rule in infectious diseases, newcomers and immigrants seem less susceptible than the native inhabitants. Debilitating causes of all sorts render individuals more susceptible. Alcoholism is perhaps the most potent predisposing factor. Persons weakened by disease are especially prone to it; thus we find many cases in connection with chronic Bright's disease, diabetes, the chronic affections of the nervous system, and protracted fevers. One important predisposing cause is a previous attack. No acute disease recurs with such frequency. Instances are on record of individuals who have had ten or more attacks.

Climate does not appear to have much influence. The disease prevails equally in cold and in hot countries, but it is stated that on this continent it is more prevalent in the Southern than in the Northern States. More important is the influence of season. Statistics everywhere show that more persons are attacked from December to May than in the summer and autumn. Seitz's large statistics of 5,905 cases in Munich give 32 per cent in winter, 36·8 per cent in spring, 15·3 per cent in summer, and 15·7 per cent in autumn. Bell's statistics of the Montreal General Hospital show practically the same distribution, but it is worth noting that during January, the coldest month of the year, in which the mean temperature for ten years was 13·75° F., the percentage was compara-

tively low. January, however, is a month with very slight variations in temperature, and it seems that the sudden changes characteristic of March, April, and May are the important climatic factors which predispose to pneumonia.

Of other factors, cold has been thought to be one of the most important, and for years was regarded as the efficient cause of the disease. Undoubtedly the disease sometimes promptly follows a sudden chilling or wetting, but in a large majority of cases no such history can be obtained.

Pneumonia follows traumatism with great frequency, more particularly injury of the chest. Litten has called special attention to this so-called *contusions-pneumonia*.

A change of opinion has of late taken place as to the nature of pneumonia, which is now almost universally regarded as a specific infectious disease, depending upon a micro-organism. Among general circumstances favoring this view, is the occurrence of pneumonia in *epidemic form*, a fact recognized by Laennec and by Grisolle. Many house epidemics have been described within the past twenty years. On several occasions I have known two, three, and even four persons admitted to hospital from the same house. In 1887, I saw, with Graham, of Toronto, a local outbreak in which three members of a family were consecutively attacked with the most malignant pneumonia. There are instances on record in which as many as ten residents in one house have been attacked. Of late years many epidemics in towns have been reported. Still more striking are the epidemics which have been described in prisons and garrisons, of which one of the most remarkable is that reported by W. B. Rodman, of Frankfort, Kentucky. In one year there occurred in a prison population of 735, 118 cases, with 25 deaths. The prison was much overcrowded at the time. Similar epidemics have been described in Europe. At the penitentiary at Amberg, from the 1st of January to the 1st of June, there were 161 cases of pneumonia with a mortality of over twenty-eight per cent.

The *diplococcus pneumoniæ* of Fraenkel is the most constant organism in lobar pneumonia and is now believed by many competent authorities to be the specific agent of the disease. It is identical with the micrococcus which Pasteur and Sternberg found in the saliva of certain individuals and which produces septicæmia in the rabbit. It occurs occasionally in the nose, the larynx, and the Eustachian tube. According to Netter's observations, it is present in the buccal secretion in twenty per cent of healthy persons. It persists for months or even years in the saliva of persons who have had pneumonia. The researches of Fraenkel, Weichselbaum, Gamaleia, and others show that it is by far the most constant organism in pneumonia and that it occurs in the secondary processes of the disease, such as pleurisy, endocarditis, pericarditis, and meningitis. In ten cases recently examined at the pathological laboratory of the Johns Hopkins Hospital by my colleague Welch, this organism was present in all; in

Herringham places the 'pneumonia season' in London from the end of March to the end of June. (B.M.J. 5.12.94.)

R – (?) Dr Harry Linter should be

six as pure cultures in the lung, in four together with pus organisms. In the sputum it may be demonstrated by treating the ordinary cover-glass preparations with glacial acetic acid and then, without washing off the acid, dropping on aniline oil and gentian-violet, which is to be poured off and renewed two or three times. The organism is seen to be a somewhat elliptical lance-shaped coccus occurring in pairs, hence the term diplococcus. It is usually encapsulated.

According to the dominant view, pneumonia is an infective disease caused by this diplococcus, which has its seat of election in and produces its chief effects on the lung, and which can, under favoring circumstances, invade other parts of the body—the pleura, meninges, and endocardium. This microbe may possibly attack these parts without the intervention of inflammation of the lung, as it has been found in meningitis and pleurisy independent of pneumonia. It is a wide-spread organism, at times present, as before stated, in the buccal secretions of healthy persons. It is not improbable that the various predisposing causes, such as cold, exhaustion, and debility, lower the vitality and render the individual susceptible, thus changing the character of the tissue-soil so that the virus can grow and produce its specific effects.

On this view, pneumonia may be regarded as a local disease, produced by micro-organisms which induce, as in other local diseases, such as erysipelas and diphtheria, constitutional disturbance of varying degrees of intensity, or even, by the further invasion of the parasites, secondary infective processes in other organs.*

Recently from Leyden's clinic very interesting studies have been issued by the brothers Klemperer on the production of immunity and upon the cure of pneumonia. Immunity is readily obtained in animals either by subcutaneous or intravenous injections of large quantities of the filtered bouillon cultures, or by the injection of the glycerine extract. The immunity, though rarely lasting more than six months, was transmitted to the offspring born within this period. Still more interesting are their observations upon the cure of the experimentally produced disease. They found that the serum and fluids of the body of an animal which had been rendered immune had the property not only of producing immunity when introduced into the circulation of another susceptible animal, but actually of curing the disease after infection had been in progress for some time. In infected animals with a body temperature of from 40° to 41° C., the fever fell to normal in twenty-four hours after the injection of serum of another animal which possessed immunity. They believe that the pneumococcus produces a poisonous albumen (pneumotoxin) which when introduced into the circulation of an animal causes elevation of temperature and the subsequent production in the body of a substance

* See on the question of etiology the elaborate essay of Wells, Journal of the American Medical Association, 1889.

(antipneumotoxin) which possesses the power of neutralizing the poisonous albumen which is formed by the bacteria. In man they hold that during the pneumonic process there is a constant absorption into the circulation of this poisonous albumen produced by the bacteria in the lungs. This continues until eventually the same antidotal substance is produced in the circulation that has been seen to occur experimentally. It is then that the crisis occurs. The bacteria are neither destroyed nor is their power to produce the poisonous albumen lessened, but the third factor, the antitoxic element, now exists and neutralizes the toxic substances as they are produced. They demonstrated that the serum of the blood of patients after the crisis of pneumonia contained the antitoxic substance and was capable, in a fair number of cases, of curing the disease when injected into infected animals. They have made preliminary observations upon patients with a view of inducing the crisis by the injection of the blood serum of persons convalescent from pneumonia, and which consequently contains the antitoxic body. In six pneumonic patients the results were promising. In all there was a decided fall of temperature in from six to twelve hours after subcutaneous injections of from four to six c. c. of the serum. The pulse and respirations were also diminished in frequency. In two cases the temperature fell to 37° C. Twice it fell and remained at normal. In the other cases it fell only temporarily. In two typhoid cases the injections were negative. The serum has no effect when injected into healthy individuals.

Morbid Anatomy.—Since the time of Laennec, pathologists have recognized three stages in the inflamed lung—engorgement, red hepatization, and gray hepatization.

In the stage of *engorgement* the lung tissue is deep red in color, firmer to the touch, and more solid, and on section the surface is bathed with blood and serum. It still crepitates, though not so distinctly as healthy lung, and excised portions float. The air-cells can be dilated by insufflation from the bronchus. Microscopical examination shows the capillary vessels to be greatly distended, the alveolar epithelium swollen, and the air-cells occupied by a variable number of blood-corpuscles and detached alveolar cells. In the stage of *red hepatization* the lung tissue is solid, firm, and airless. If the entire lobe is involved it looks voluminous, and shows indentations of the ribs. On section the surface is dry, reddish brown in color, and has lost the deeply congested appearance of the first stage. One of the most remarkable features is the friability; in striking contrast to the healthy lung, which is torn with difficulty, a hepatized organ can be readily broken by the finger. Careful inspection shows that the surface is distinctly granular, the granulations representing fibrinous plugs filling the air-cells. The distinctness of this appearance varies greatly with the size of the alveoli, which are about 0·10 mm. in diameter in the infant, 0·15 or 0·16 in the adult, and from 0·20 to 0·25 in old age. On scraping the surface with a knife a reddish viscid serum is

removed, containing small granular masses. The smaller bronchi often contain fibrinous plugs. If the lung has been removed before the heart, it is not uncommon to find solid moulds of clot filling the blood-vessels. Microscopically, the air-cells are seen to be occupied by coagulated fibrin in the meshes of which are red blood-corpuscles, polynuclear leucocytes, and alveolar epithelium. The alveolar walls are infiltrated and leucocytes are seen in the interlobular tissues. Cover-glass preparations from the exudate, and thin sections show, as a rule, the diplococci already referred to, many of which are contained within cells. Staphylococci and streptococci may also be seen in some cases. In the stage of *gray hepatization* the tissue has changed from a reddish-brown to a grayish-white color. The surface is moister, the exudate obtained on scraping is more turbid, the granules in the acini are less distinct, and the lung tissue is still more friable. Histologically, in gray hepatization, it is seen that the air-cells are densely filled with leucocytes, the fibrin network and the red blood-corpuscles have disappeared. A more advanced condition of gray hepatization is that known as *purulent infiltration*, in which the lung tissue is softer and bathed with a purulent fluid.

The stage of gray hepatization appears to be the first step in the process of *resolution*. The exudate is softened, the cell elements are disintegrated and rendered capable of absorption. When the purulent infiltration of the lung tissue reaches the grade sometimes seen post mortem, it is probable that resolution could not take place. Small abscess cavities may arise, and by their fusion larger ones. Often in one lung, or even in one lobe, the various stages of the process may be seen, and the passage of the engorgement into red hepatization and of the latter into the gray stage can be readily traced.

The general details of the morbid anatomy of pneumonia may be gathered from the following facts, based on 100 autopsies, made by me at the General Hospital, Montreal: In 51 cases the right lung was affected; in 32, the left; in 17, both organs. In 27 cases the entire lung, with the exception, perhaps, of a narrow margin at the apex and anterior border, was consolidated. In 34 cases, the lower lobe alone was involved; in 13 cases, the upper lobe alone. When double, the lower lobes were usually affected together, but in three instances the lower lobe of one and the upper lobe of the other were attacked. In three cases also, both upper lobes were affected. Occasionally the disease involves the greater part of both lungs; thus, in one instance the left organ with the exception of the anterior border was uniformly hepatized, while the right was in a stage of gray hepatization, except a still smaller portion in the corresponding region. In a third of the cases, red and gray hepatization existed together. In 22 instances there was gray hepatization. As a rule the unaffected portion of the lung is ~~usually~~ congested or œdematous. When the greater portion of a lobe is attacked, the uninvolved part may be in a state of almost gelatinous œdema. The unaffected lung is usually congested, particularly

at the posterior part. This, it must be remembered, may be largely due to post-mortem subsidence. The uninflamed portions are not always congested and œdematous. The upper lobe may be dry and bloodless when the lower lobe is uniformly consolidated. The average weight of a normal lung is about 600 grammes, while that of an inflamed organ may be 1,500, 2,000, or even 2,500 grammes.

The bronchi contain, as a rule, at the time of death a frothy serous fluid, rarely the tenacious mucus so characteristic of pneumonic sputum. The mucous membrane is usually reddened, rarely swollen. In the affected areas the smaller bronchi often contain fibrinous plugs, which may extend into the larger tubes, forming perfect casts. The bronchial glands are swollen and may even be soft and pulpy. The pleural surface of the inflamed lung is invariably involved when the process becomes superficial. Commonly, there is only a thin sheeting of exudate, producing slight turbidity of the membrane. In only two of the hundred instances the pleura was not involved. In some cases the fibrinous exudate may form a creamy layer an inch in thickness. A serous exudation of variable amount is not uncommon.

Lesions in other Organs.—The heart is distended with firm, tenacious coagula, which can be withdrawn from the vessels as dendritic moulds. In no other acute disease do we meet with coagula of such solidity and firmness. The distention of the right chambers of the heart is particularly marked. The left chambers are rarely distended to the same degree. The spleen is often enlarged, though in only 35 of the 100 cases was the weight above 200 grammes. The kidneys show parenchymatous swelling, turbidity of the cortex, and, in a very considerable proportion of the cases —twenty-five per cent—chronic interstitial changes.

Pericarditis is not infrequent, and occurs more particularly with pneumonia of the left side and with double pneumonia. In 5 of the 100 autopsies it was present, and in 4 of them the lappet of lung overlying the pericardium with its pleura was involved. Endocarditis is more frequent and occurred in 16 of the 100 cases. In 5 of these the endocarditis was of the simple character; in 11 the lesions were ulcerative. Fatty degeneration of the heart is not common except in protracted cases.

Meningitis is not infrequently found, and in many cases is associated with malignant endocarditis. It was present in 8 of the 100 autopsies. Of twenty cases of meningitis in ulcerative endocarditis fifteen occurred in pneumonia. The meningeal inflammation in these cases is usually cortical.

Croupous or diphtheritic inflammation may occur in other parts. A croupous colitis, as pointed out by Bristowe, is not very uncommon. It occurred in 5 of my 100 post-mortems. It is usually a thin, flaky exudation, most marked on the tops of the folds of the mucous membrane. In one case there was a patch of croupous gastritis, covering an area of 12 by 8 cm., situated to the left of the cardiac orifice.

The liver shows parenchymatous changes and often extreme engorgement of the hepatic veins.

Symptoms.—Abruptly, or preceded by a day or two of indisposition, the patient has a severe chill, lasting from ten to thirty minutes. In no acute disease is an initial chill so constant or so severe. The fever rises quickly. There is pain in the side, often of an agonizing character. A short, dry, painful cough soon develops, and the respirations are increased in frequency. When seen on the second or third day the patient presents an appearance which may be quite pathognomonic. He lies flat in bed, often on the affected side; the face is flushed, particularly the cheeks; the breathing is hurried; the alæ nasi dilate with each inspiration; the eyes are bright, the expression is anxious, and there is a frequent short cough which makes the patient wince and hold his side. The expectoration is blood-tinged and extremely tenacious. The temperature rises rapidly to 104° or 105°. The pulse is full and bounding and the pulse-respiration ratio much disturbed. Examination of the lung shows the physical signs of consolidation—blowing breathing and fine râles. After persisting for from seven to ten days the crisis occurs, and with a fall in the temperature the patient passes from a condition of extreme distress and anxiety to one of comparative comfort.

The fever of pneumonia rises abruptly with the chill, during which the rectal temperature may be high. In children and in cases without chill the rise is more gradual. The temperature reaches 104° or 105° and is continuous, with a variation of a degree to a degree and a half. If a two-hour record is kept the diurnal variations are seen to follow the normal type. In children and healthy adults the fever is usually higher than in old persons and drunkards. After continuing for from five to nine days the temperature falls abruptly, forming what is known as the *crisis*, so characteristic in a large proportion of the cases. In from five to twelve hours the temperature may fall eight degrees. The crisis may occur as early as the third day or as late as the twelfth or fourteenth. A *pseudo-crisis* may occur on the fifth day or earlier. Defervescence may take place gradually by lysis. In cases of delayed resolution the fever may persist for weeks.

Respiratory Symptoms.—Pain of an agonizing character is an early and distressing symptom. It is usually referred to the nipple or axillary regions of the affected side. In exceptional cases it may be in the abdomen or flank, or even beneath the shoulder-blade. Deep inspiration and cough aggravate it. Dyspnœa is a very prominent feature. The respirations may be from forty to sixty in the minute and in exceptional cases and in children may rise to eighty. To produce this shortness of breath many factors combine—the fever, the loss of function in a considerable area of lung tissue, and the excessive pain in the side, which makes it impossible to draw a deep breath. There may be nervous factors at work, as with the crisis the number of respirations may fall nearly to normal,

while the consolidation of the lung still persists. The type of breathing in pneumonia is peculiar and almost distinctive. The inspirations are



CHART XV.—Fever, pulse, and respirations in lobar pneumonia.

short and superficial. Expiration is often associated with a short grunt. The ratio between the respirations and pulse may be 1 to 2, or even 1 to

1·5. In no other disease do we see such marked disturbance in the pulse-respiration ratio, and this is sometimes an aid in diagnosis.

The cough is also very characteristic—frequent, short, restrained, and associated with great pain in the side. It is at first dry, hard, and without expectoration. In old persons and drunkards and in those debilitated by long illness there may be no cough. The sputum is mucoid at first, but within twenty-four hours shows special features. A brisk hæmoptysis may be an initial symptom. Pneumonic sputum is viscid, tenacious, and blood-tinged. The gummous viscidity, together with the red blood-corpuscles in various stages of alteration, give pathognomonic characters to the sputa, unknown in any other disease. The rusty tinge becomes more marked as the disease progresses, and so tenacious is the expectoration that it has to be wiped from the lips of the patient, and a spit-cup, half full, may be inverted without spilling. Toward the close it becomes more liquid and is more readily expelled. In low types of the disease the sputum may be fluid and dark brown, resembling prune juice. The amount is very variable. In children and old people there may be none; ordinarily, however, there are from 100 to 300 c. c. daily. After the crisis the quantity is variable; abundant in some cases, absent in others. Microscopically, the sputum contains red blood-corpuscles in all stages of degeneration, alveolar epithelium, diplococci and other micro-organisms, cell-moulds of the alveoli, and, in some cases, small fibrinous casts of the bronchioles. The latter are sometimes plainly visible to the naked eye.

Physical Signs.—*Inspection* may not at first show any difference between the two sides, though usually if the lower lobe of a lung is involved the movement is less on the affected side. Later, when consolidation has occurred, particularly if it is massive, this deficient expansion is very marked. Mensuration may show a definite increase in the volume of the side involved. The intercostal spaces are not obliterated. Palpation indicates still more clearly the lack of expansion, and a pleural friction may be felt. Tactile fremitus is increased. These signs are all more marked when consolidation is established.

Percussion.—In the stage of engorgement the note is higher pitched and may have a somewhat tympanitic quality, the so-called Skoda's resonance. This can often be obtained over the lung tissue just above a consolidated area. When the lung is hepatized, the percussion note is flat, the quality of the flatness varying a good deal from a note which has in it a certain tympanitic quality to absolute dulness. There is not the wooden flatness of effusion and the sense of resistance is not so great. During resolution the tympanitic quality of the percussion note may return. For weeks or months after convalescence there may be a higher-pitched note on the affected side.

Auscultation.—Quiet, suppressed breathing in the affected part is often a marked feature in the early stage, and is always suggestive. Very early there is heard at the end of inspiration the fine crepitant râle, a series of

minute cracklings heard close to the ear, and perhaps not audible until a full breath is drawn. Whether this is a fine pleural crepitus or is produced in the air-cells and finer bronchi is still an open question. At this stage, before consolidation has occurred, the breath-sounds may be, as before mentioned, much feebler than in health, but on drawing a long breath they may have a harsh quality, to which the term broncho-vesicular has been applied. In the stage of red hepatization and when dulness is well defined, the respiration is tubular, similar to that heard in health over the larger bronchi. With this blowing breathing there may be no râles, and it may present an intensity unknown in any other pulmonary affection. It is simply the propagation of the laryngeal and tracheal sounds through the bronchi and the consolidated lung tissue. The permeability of the bronchi is essential to its production. Tubular breathing is absent in certain cases of massive pneumonia in which the larger bronchi are completely filled with exudation. When resolution begins mucous râles of all sizes can be heard. At first they are small and have been called the *redux-crepitus*. The voice-sounds are transmitted through the consolidated lung with great intensity. This bronchophony may have a curious nasal quality to which the term ægophony has been given.

Circulatory Symptoms.—During the chill the pulse is small, but in the succeeding fever it becomes full and bounding. In cases of moderate severity it ranges from 100 to 116. It is not often dicrotic. In strong, healthy individuals and in children there may be no sign of failing pulse throughout the attack. With extensive consolidation the left ventricle may receive a very diminished amount of blood and the pulse in consequence may be small.

In the old and feeble the pulse may be small and rapid from the outset. The heart-sounds are usually loud and clear. During the intensity of the fever, particularly in children, *bruits* are not uncommon both in the mitral and in the pulmonary areas. The second sound over the pulmonary artery is accentuated. Attention to this sign gives a valuable indication as to the condition of the lesser circulation. With distention of the right chambers and failure of the right ventricle to empty itself completely the pulmonary second sound becomes much less distinct. When the right heart is engorged there may be an increase in the dulness to the right of the sternum. With gradual heart-failure and signs of dilatation the long pause is greatly shortened, the sounds approach each other in tone and have a fœtal character (embryocardia).

Blood.—The number of red corpuscles is reduced, but, in consequence of the comparative shortness of the attack, we rarely see the anæmia associated with other febrile disorders. No special changes occur in the corpuscles themselves. The colorless corpuscles are increased in number from about 6,000 per c. mm., the normal number, to 10,000, or even more. This leucocytosis disappears as soon as crisis occurs. Its absence during the fastigium is considered to indicate an unfavorable prognosis. A striking

much.

feature in the blood-slide is the richness and density of the fibrin network. This corresponds to the great increase in the fibrin elements, which has long been known to occur in pneumonia, the proportion rising from four to ten parts per thousand. Hayem describes the blood-plates as greatly increased. The diplococci can very rarely be demonstrated in the blood.

The *gastro-intestinal symptoms* are those associated with an ordinary sthenic fever. Vomiting is not frequent at the outset. There is naturally loss of appetite. The tongue is white and furred, and, in cases of a low type, rapidly becomes dry. Constipation is more common than diarrhœa, which does prevail, however, in some epidemics. The spleen is usually enlarged, and the edge can be felt during a deep inspiration. Except in cases of extreme engorgement of the right heart, the liver is usually not increased in volume.

Among *cutaneous* symptoms one of the most interesting is the association of herpes with pneumonia. Not excepting malaria, we see labial herpes more frequently in this than in any other disease, occurring, as it does, in from twelve to forty per cent of the cases. It is supposed to be of favorable prognosis, and figures have been quoted in proof of this assertion. It may also occur on the nose or on the genitals. Its significance and relation to the disease are unknown. It is scarcely necessary to mention the theory which has been advanced, that it is an external expression of a neuritis which involves the pneumogastric and induces the pneumonia. At the height of the disease sweats are not common, but at the crisis they may be profuse. Redness of one cheek is a phenomenon long recognized in connection with pneumonia, and is usually on the same side as the disease.

The *urine* presents the usual febrile characters of high color, high specific gravity, high density, and increased acidity. The nitrogenous elements, urea and uric acid, are notably increased. The chlorides are absent, or greatly reduced, during the height of the fever—due, it is supposed, to the amount exuded in the hepatized lung. At the crisis there may be marked increase in the amount of urine, which is heavily laden with urates and extractives. When jaundice occurs there is bile-pigment. A trace of albumen is present in a large proportion of the cases. It is rarely of serious significance, and seldom associated with tube-casts.

Cerebral Symptoms.—As an initial symptom, headache is common. Consciousness is usually retained throughout, even in severe cases. In children convulsions are common, and in at least one half the cases usher in the disease. There may be violent maniacal symptoms in the adult. I once performed an autopsy in a case of this kind in which there was no suspicion whatever that the disease was other than acute mania. In drunkards the symptoms from the outset may be those of delirium tremens, in which disease it should be an invariable rule, even if fever is not present, to examine the lungs. These patients are apt to wander about, and must

be carefully watched. The preliminary excitement and delirium may give place to hebetude, which deepens to coma. It is not possible to decide in these cases whether meningitis is present or not, since it is usually cortical, and there are no symptoms of pressure on the nerves. In only one of eight instances was there involvement of the base, rendering clear the diagnosis of meningitis. These cases of so-called cerebral pneumonia are frequently associated with very high fever. In senile and alcoholic pneumonia, however, the temperature may be low and yet brain symptoms very pronounced. Mental disturbance may persist during and after convalescence, and insanity develops in a few cases. It is currently stated that apex pneumonia is more often complicated with severe delirium, but it has not been so in my experience.

Complications.—Many of these seem to depend directly on the invasion of the body by the diplococci.

As already mentioned, *pleurisy* is an inevitable event when the inflammation reaches the surface of the lung, and thus can scarcely be termed a complication. But there are cases in which the pleuritic features take the first place—cases to which the term pleuro-pneumonia is applicable. The exudation may be sero-fibrinous with copious effusion, differing from that of an ordinary acute pleurisy in the greater richness of the fibrin, which may form thick, tenacious, curdy layers. Pneumonia on one side with extensive pleurisy on the other is sometimes a puzzling complication to diagnose and an aspirator needle may be required to settle the question. The bacteriological examination of the fluid has demonstrated, in a large number of cases, the presence of the pneumococcus. Of late, special attention has been paid to the frequency with which empyema complicates pneumonia. Effusion may not have been suspected during the height of the disease, but after the temperature has been normal for some days a slight rise occurs and the irregular fever persists. Dulness continues at the base, or may have extended. The breathing is feeble and there are no râles. Such a condition may be closely simulated, of course, by the thickened pleural layers which are so commonly found after the pneumonia. The question should be settled at once by the introduction of the needle. It is by no means an uncommon complication, and many cases of empyema supposed to be primary are in reality secondary to a slight pneumonia.

Pericarditis is more common in the pneumonia of children, particularly when double, and it is said with the pneumonia of the left side. It was present, as I stated, in five of my one hundred autopsies. Though usually plastic, there may be much serous effusion. There is rarely any difficulty in the diagnosis, but when the pneumonia involves the portion of lung covering the pericardium, there may be difficulty in determining, by physical signs, the existence of fluid. The increase in the dyspnœa, the greater feebleness of the pulse, and the gradual suppression of the heart-sounds will give the most valuable indications. In some instances

Transient aphasia has been met with in a few instances — setting in abruptly with or without hemiplegia. The condition may pass away in a few days — or even in a few hours — and is not as a rule serious unless connected with hemiplegia and in association with endocarditis.

the fluid is purulent. Though a very serious event, it is surprising how often recovery takes place even in the most desperate cases of pneumonia complicated with pericarditis. I remember that the late Dr. Murchison some years ago commented upon this feature in a case at St. Thomas's Hospital.

Endocarditis is still more frequent, and in my one hundred autopsies was present in sixteen. I called attention in the Gulstonian lectures for 1885 to the great frequency of this complication. Of 209 cases of malignant endocarditis collected from the literature, 54 cases occurred in this disease. Subsequent observations have fully confirmed this statement. It may be said that with no acute febrile disease is endocarditis so frequently associated. It is much more common in the left heart than in the right. It is particularly liable to attack persons with old valvular disease. There may be no symptoms indicative of this complication even in very severe cases. It may, however, be suspected in cases (1) in which the fever is protracted and irregular; (2) when signs of septic mischief arise, such as chills and sweats; (3) when embolic phenomena appear. The frequent complication of meningitis with the endocarditis of pneumonia, which has already been mentioned, gives prominence to the cerebral symptoms in these cases. The physical signs may be very deceptive. There are instances in which no cardiac murmurs have been heard. In others the development under observation of a loud, rough murmur, particularly if diastolic, is extremely suggestive.

Changes in the myocardium are not uncommon, rarely more, however, than cloudy swelling of the fibres; but in some instances there is fatty change.

Ante-mortem heart-clots are rare in pneumonia, even in the extreme grade of dilatation of the right chamber. In not a single instance of my autopsies were there globular thrombi in the auricles or in apices of the ventricles. In protracted cases thrombi occasionally form in the veins. A rare complication is embolism of one of the larger arteries. I saw an instance in Montreal of embolism of the femoral artery at the height of pneumonia, which necessitated amputation at the thigh. The patient recovered.

By far the most important complication is the pneumonic *meningitis*, which varies much at different times and in different places. My Montreal experience is rather exceptional, as eight per cent of the fatal cases had this complication. It usually comes on at the height of the fever and in the majority of the cases is not recognized unless, as before mentioned, the base is involved, which is not common. Meningitis may develop later in the disease and is then more easily diagnosed. Associated as it so often is with ulcerative endocarditis, there may be embolism of the cerebral arteries, inducing hemiplegia. Among rare complications may be mentioned *peripheral neuritis*, of which several instances have been described. I saw one well-marked instance, following pneumonia and influenza, in the

spring of 1890. There was neuritis of the left arm with considerable wasting.

Serious *gastric complications* are rare. A croupous gastritis has already been mentioned. The *croupous colitis* may induce severe diarrhœa. *Jaundice* is one of the most interesting complications of pneumonia and occurs with curious irregularity in different outbreaks of the disease. It sets in early, is rarely very intense, and has not the characters of obstructive jaundice. There are cases in which it assumes a very serious form. The mode of production is not well ascertained. It does not appear to bear any definite relation to the degree of hepatic engorgement and it is certainly not due to catarrh of the ducts. Possibly it may be, in great part, hæmatogenous.

Parotitis occasionally occurs, commonly in association with endocarditis.

A rare complication of pneumonia is an *arthritis* resembling rheumatism, which may come on gradually during the disease or in the convalescence.

Bright's disease does not often follow pneumonia. Peritonitis is exceedingly rare.

Relapse in pneumonia is so uncommon that some good observers have doubted its occurrence. I have never seen an instance in which I was certain that there was a definite relapse. There are cases in which from the ninth to the eleventh day the fever subsides, and after the temperature has been normal for a day or two, a rise occurs and fever may persist for another ten days or even two weeks. Though this might be termed a relapse, it is more correct to regard it as an instance of an anomalous course of delayed resolution. Wagner, who has studied the subject carefully, says that in his large experience of 1,100 cases he met with only 3 doubtful cases. When it does occur, the attack is usually abortive and mild.

Recurrence is more common in pneumonia than in any other acute disease. Rush gives an instance in which there were twenty-eight attacks. Other authorities narrate cases of eight, ten, and even more attacks.

Formerly it was much disputed whether ordinary lobar pneumonia ever terminated in pulmonary phthisis. These are really cases of tuberculo-pneumonic phthisis the onset of which may resemble acute pneumonia.

Clinical Varieties.—A number of different forms of pneumonia have been recognized, such as malignant, adynamic, bilious, malarial, rheumatic, and the like, but they scarcely require a full description. A malarial pneumonia is described and is thought to be very prevalent in some parts of this country. Although I have seen during the past seven years several hundred cases of malaria and am familiar with the bronchial trouble so commonly associated with it, I have yet to see an instance of pneumonia which seemed in any way connected with paludism. The so-called

rheumatic pneumonia has, so far as I know, no peculiarities; nor has rheumatism, I think, any special relation to the disease. The term typhoid pneumonia is commonly used to designate cases with adynamic symptoms and it is to be distinguished from those cases in which typhoid fever begins with a definite pneumonia, the so-called *pneumo-typhus* of foreign writers.

Epidemic pneumonia is, as a rule, more fatal and may display minor peculiarities which differ in different epidemics. In some the cerebral complications are marked; in others, the cardiac. There may be diarrhœa. The pneumonia which occurs with influenza, and was so common in the last epidemic, presents no special features other than the peculiarities of onset. Perhaps, also, it was more severe and more fatal. In diabetic patients pneumonia runs a rapid and severe course, ending sometimes in abscess or gangrene. In the subjects of chronic alcoholism the onset of pneumonia is insidious, the symptoms may be masked, the fever slight, and the clinical picture may be that of delirium tremens. So latent is the disease in some of these cases that the thermometer alone may indicate the presence of an acute disease.

At the extremes of life pneumonia presents certain well-marked features. It is sometimes seen in the new-born. In *infants* it very often sets in with a convulsion. The summit of the lung seems more frequently involved than in adults and the cerebral symptoms are more marked throughout. The torpor and coma, particularly if they follow convulsions, and the preliminary stage of excitement, may lead to the diagnosis of meningitis. Holt has recently published figures which indicate that lobar pneumonia is not uncommon in infants under two years of age. Pneumonic sputum is rarely seen in children.

In *old age* pneumonia may be latent, coming on without chill; the cough and expectoration are slight, the physical signs ill-defined and changeable, and the constitutional symptoms out of all proportion to the extent of the local lesion.

When pneumonia is prevailing extensively, particularly in jails and garrisons, cases are found which have some of the initial symptoms of the disease—perhaps a slight chill, moderate fever, and a few indefinite local signs. This is the so-called *larval pneumonia*. *Apex pneumonia* is said to be more often associated with adynamic features and with marked cerebral symptoms. The expectoration and cough may be slight. I cannot say that in my experience the cerebral symptoms in adults have been more marked in this form, nor do I think it necessarily graver than if situated at the base.

The creeping or *migratory pneumonia* successively involves one lobe after the other and is a peculiar and well-recognized variety.

Double pneumonia presents no peculiarities other than the greater danger connected with it. The term *massive pneumonia* is applied to the rare condition in which not alone the air-cells but the bronchi of the entire

lobe or even of the lung are filled with the fibrinous exudate. The auscultatory signs are absent; there is neither fremitus nor tubular breathing, and on percussion the lung is absolutely flat. It closely resembles pleurisy with effusion. The moulds of the bronchi may be expectorated in violent fits of coughing.

Prognosis.—In a disease which carries off one in every four or five of those attacked the prognosis in a large number of cases is necessarily grave. In children and in healthy adults the outlook is good. In the debilitated, in drunkards, and in the aged the chances are against recovery. So fatal is it in the latter class that it has been termed the natural end of the old man. Many circumstances, of course, influence prognosis, particularly the extent of the disease, the height of the fever, the presence of other diseases, and the occurrence of complications.

When a lower lobe on one side or the lower and middle lobes of the right side are involved in a healthy adult, if there are no complications, the case usually proceeds to satisfactory resolution. Meningitis is a fatal complication. Endocarditis is extremely grave, much more so than pericarditis, from which many cases recover. Early signs of heart-failure, dilatation of the right chamber, gradual cyanosis, and œdema of the lungs, are symptoms of the most serious character. As before stated, the danger of heart-clot is not great in pneumonia. The risk is in the extreme distention of the right chamber. I believe the firm fibrinous coagula entangled in the columnæ carneæ and the valves are invariably produced during the death agony. When there are symptoms of abscess of the lung or of gangrene the prognosis is extremely bad; yet cases are on record of recovery from both these conditions. Increasing rapidity of respiration, with difficulty in expectoration, very liquid and dark sputa, a low muttering delirium, dry tongue, and failing pulse, with a suffused lividity of the face, are indicative of approaching dissolution. Death rarely occurs from direct interference with the function of respiration, though it may happen in cases of extensive double pneumonia. In a majority of cases the fatal result is brought about by gradual heart-failure, whether induced by the prolonged action of the fever, the specific action of the poison, or paralysis due to overdistension of the right ventricle. A collateral œdema of the uninvolved portion of the lung, so much spoken of, rarely, I believe, occurs in pneumonia; nor is it likely, if the observations of Welch upon the production of this condition are correct, that in the course of pneumonia the left ventricle can be disproportionately weak in comparison with the right.

Termination.—*Resolution*, the process by which the lung is restored to its normal state, is effected partly by expectoration and partly by liquefaction and absorption of the exudate. It is not always possible to estimate the share respectively taken by these processes. There are cases in which a rapid resolution of extensive consolidation takes place without any special increase in the expectoration; and, on the other hand, during

resolution it is not uncommon to find in the expectoration the little plugs of fibrin and leucocytes which have been loosened from the air-cells and expelled by coughing. In a majority of cases both processes are probably at work. A variable time is taken in the restoration of the lung. Sometimes within a week or ten days the dulness is greatly diminished, the breath-sounds become clear, and, so far as physicial signs are any guide, the lung seems perfectly restored. It is to be remembered that in any case of pneumonia with extensive pleurisy a certain amount of dulness will persist for months, owing to thickening of the pleura. *Delayed resolution* is a condition which causes much anxiety to the physician. It may be postponed until the fourth, eighth, or even the tenth week. Usually the fever subsides, but the consolidation of the lung may persist, with great improvement in the general condition of the patient. In apex pneumonia the resolution is more apt to be retarded. It has been stated that bleeding is one cause of delayed resolution. A solid exudation can persist for weeks and yet the integrity of the lung may be ultimately restored. Grissole describes the lung from a patient who died on the sixtieth day in which the affected part looked not unlike the acute disease.

Abscess may result from purulent infiltration of the lung tissue. It occurred in 4 of my 100 cases. Usually the lung breaks in limited areas and the abscesses are not large, but they may involve a considerable portion of a lobe. This most serious complication is indicated by cavernous signs and the expectoration of purulent material containing elastic tissue. The constitutional symptoms are usually very severe. In a large majority of the clinical cases in which abscess of the lung is believed to follow an acute pneumonia, the process has in reality been rapid tuberculous consolidation with breaking of the lung tissue. There can, however, be no reasonable doubt that abscess of the lung does occur as a rare sequence of ordinary pneumonia.

Gangrene.—The presence of this complication is rendered evident by the horribly fetid odor of the expectoration, the presence of lung tissue, and crystals of fatty acids. It occurred in 3 of my 100 autopsies.

Fibroid Induration.—That a chronic interstitial pneumonia may follow the ordinary acute disease cannot be questioned, though it is probably the rarest of all terminations. It was present in one of my 100 autopsies. The patient, aged fifty-eight, died on the thirty-second day after the initial chill. The right lung was uniformly solid, grayish in color, firm, and presented in places a translucent, smooth, homogeneous aspect. In these areas the alveolar walls were thickened and the fibrinous plugs filling the air-cells were undergoing transformation into a new growth of connective tissue.

Mortality.—Pneumonia is one of the most fatal of acute diseases. Hospital statistics show that the mortality ranges from twenty to forty per cent Of 1,012 cases at the Montreal General Hospital, the mortality was 20·4 per cent. It appears to be somewhat more fatal in southern

climates. Of 3,969 cases treated at the Charity Hospital, New Orleans, the death rate was 28·01 per cent. It has been urged that the mortality in this disease has been steadily increasing, and attempts have been made to connect this increase with the expectant plan of treatment at present in vogue. But the careful and thorough analysis by C. N. Townsend and A. Coolidge, Jr.,* of 1,000 cases at the Massachusetts General Hospital indicates clearly that, when all circumstances are taken into consideration, this conclusion is not justified. They found that when all fatal cases over fifty years of age were omitted, and those patients who were delicate, intemperate, or the subject of some complication, there was very little variation from decade to decade, and that, excluding these cases, the rate was but little over ten per cent. In answer to the assertion that the modified treatment is in part responsible for the increased mortality, these authors show clearly that the rise in death rate took place in the period prior to 1860, when the treatment was entirely or in great part heroic.

According to the recent analysis of 708 cases at St. Thomas's Hospital by Hadden, H. W. G. McKenzie, and W. W. Ord, the mortality progressively increases from the twentieth year, rising from 3·7 per cent under that age to 22 per cent in the third decade, 30·8 per cent in the fourth, 47 per cent in the fifth, 51 per cent in the sixth, 65 per cent in the seventh decade.†

Diagnosis.—No disease is more readily recognized in a large majority of the cases. The external characters, the sputa, and the physical signs combine to make one of the clearest of clinical pictures. After a study in the post-mortem room of my own and others' mistakes, I think that the ordinary lobar pneumonia of adults is rarely overlooked. Judging from my autopsy records, I should say that errors are particularly liable to occur in the intercurrent pneumonias, in those complicating chronic affections, and in the disease as met with in children, the aged, and drunkards. Tubercule-pneumonic phthisis is frequently confounded with pneumonia. Pleurisy with effusion is, I believe, not often mistaken except in children.

In diabetes, Bright's disease, chronic heart-disease, pulmonary phthisis, and cancer, an acute pneumonia often ends the scene, and is frequently overlooked. In these cases the temperature is perhaps the best index, and should, more particularly if cough develops, lead to a careful examination of the lungs. The absence, however, of expectoration and sometimes the entire absence of pulmonary symptoms makes a diagnosis very difficult.

In children there are two special sources of error; the disease may be entirely masked by the cerebral symptoms and the case mistaken for one of meningitis. It is remarkable in these cases how few indications there are of pulmonary trouble. The other condition is pleurisy with effusion,

* Boston Medical and Surgical Journal, 1889.

223,730 cases collected by Wells from various sources
40,276 died – a mortality of 18.1 % (Ann. Jr. gen. Med
ars 1.9.92

rewrite. treatment section (Leech)

which in children often has deceptive physical signs. The breathing may be intensely tubular and tactile fremitus may be present. The exploratory needle is sometimes required to decide the question. In the old and debilitated a knowledge that the onset of pneumonia is insidious, and that the symptoms are ill-defined and latent, should place the practitioner on his guard and make him very careful in the examination of the lungs in doubtful cases. In chronic alcoholism the cerebral symptoms may predominate and completely mask the local disease. As mentioned, the disease may assume the form of violent mania, but more commonly the symptoms are those of delirium tremens. In any case rapid pulse, rapid respiration, and fever are symptoms which should invariably excite suspicion of inflammation of the lungs.

Pneumonia is rarely confounded with ordinary consumption, but to differentiate acute tuberculo-pneumonic phthisis is often difficult. The case may set in with a chill. It may be impossible to determine which condition is present until softening occurs and elastic tissue and tubercle bacilli appear in the sputum. A similar mistake is sometimes made in children. With typhoid fever, pneumonia is not infrequently confounded. There are instances of pneumonia with the local signs well marked in which the patient rapidly sinks into what is known as the typhoid state, with dry tongue, rapid pulse, and diarrhœa. Unless the case is seen from the outset it may be very difficult to determine the true nature of the malady. On the other hand, there are cases of typhoid fever which set in with symptoms of lobar pneumonia—the so-called pneumo-typhus. It may be impossible to make a differential diagnosis in such a case unless the characteristic eruption develops.

Treatment.—Pneumonia is a self-limited disease, and runs its course uninfluenced in any way by medicine. It can neither be aborted nor cut short by any known means at our command. Even under the most unfavorable circumstances it will terminate abruptly and naturally, without a dose of medicine having been administered. A patient was admitted into one of my wards at the Philadelphia Hospital on the evening of the seventh day after the chill, in which he had been seen by one of my assistants, who had ordered him to go to hospital. He remained, however, in his house alone, without assistance, taking nothing but a little milk and bread and whisky, and was brought into the hospital by the police in a condition of active delirium. That night his temperature was 105° and his pulse above 120. In his delirium he came near escaping through the window of the ward. The following morning—the eighth day—the crisis occurred, and at ward class his temperature was below 98°. The entire lower lobe of the right side was found involved, and he entered upon a rapid convalescence. So also, under the favoring circumstances of good nursing and careful diet, the experience of many physicians in different lands has shown that pneumonia runs its course in a definite time, aborting sometimes spontaneously on the third or the fifth day, or continuing until the tenth or twelfth.

We have, then, no specific treatment for pneumonia. In cases of moderate severity a purely expectant plan may be followed—keeping the bowels open, regulating the diet, and, if necessary, giving a Dover's powder at night to procure sleep. In severer cases a symptomatic plan of treatment should be pursued, meeting the indications as they arise. The first distressing symptom is usually the pain in the side, which may be relieved by local depletion—by cupping or leeching—or, better still, by a hypodermic injection of morphia. In many cases the question comes up at the outset as to the propriety of venesection. The reproach of Van Helmont, that "a bloody Moloch presides in the chairs of medicine," cannot be brought against the present generation of physicians. During the first five decades of this century the profession bled too much, but during the last decades we have certainly bled too little. Pneumonia is one of the diseases in which a timely venesection may save life. To be of service it should be done early. In a full-blooded, healthy man with high fever and bounding pulse the abstraction of from twenty to thirty ounces of blood is in every way beneficial, relieving the pain and dyspnœa, reducing the temperature, and allaying the cerebral symptoms, so violent in some instances. Unfortunately, in a majority of the cases, bleeding is now used at a late stage in the disease, when the heart is beginning to fail, the right chambers are dilated, the face is of a dusky hue, the respirations are very rapid, and there are signs, perhaps, of œdema of the uninvolved portions of the lungs. Though resorted to rather as a forlorn hope, it is a rational practice, and, in cases of emphysema and of heart-disease, proves satisfactory under identical hydraulic indications, but, unfortunately, in a majority of the cases of pneumonia it proves futile. Time and again, in such cases, have I urged free venesection, but in twelve hospital patients bled under these circumstances only one recovered.

In the majority of cases requiring treatment the indications are to lower the temperature and to support the heart.

Fever alone is not, I think, hurtful; but it is difficult to differentiate the effects of fever and of the poisons circulating in the blood. It is not impossible, as some suppose, that the fever may be directly beneficial; still, high and prolonged pyrexia is undoubtedly dangerous and should be combated. Of efficient measures cold unquestionably heads the list. Perhaps the most convenient way is the application of ice-bags to the affected side—a practice long followed in Germany and now becoming prevalent in England and America. When the temperature is above 103° or 103·5° sponging may be resorted to. If the high fever is combined with brain symptoms the bath at 70° may be used without risk.

The use of medicinal antipyretics in pneumonia is of doubtful propriety. Quinine has been much vaunted. Personally I cannot speak of any special advantages which I have seen from its use. From thirty to sixty grains daily will reduce the temperature, in a certain proportion of the cases, one or two degrees, but in this respect it is far below other antipy-

The young practitioner may bear in mind that more cases are damaged by the promiscuous drugging which is still only too prevalent than helped by the

Italics

Digitalis

I can speak most favorably of the local application of cold

retics. It is also not without ill effects in disturbing digestion or even causing vomiting, and, according to some writers—though this I have never noticed—inducing marked cardiac weakness and depression. Antipyrin, antifebrin, and phenacetin have had a thorough trial in pneumonia, and, although they still have their advocates, the general opinion of clinical physicians seems decidedly against their systematic employment.

The progressive cardiac weakness is, after all, the most important enemy to fight in pneumonia and is emphasized by the old axiom, *Sine pulsu nulla therapeia.* Doubtless this is in part caused by the fever, but much more important is the toxic action of the poisons produced in the course of the disease. To these must be added the third factor, overdistention of the right chambers of the heart. We are still without an agent which can counteract the gradual influence of the poisons which develop in the course of acute febrile diseases, such as typhoid fever, pneumonia, and diphtheria, the chief effect of which is exercised upon the circulation, increasing the rapidity of the pulse and inducing a progressive heart-failure. To meet this indication the general experience of physicians still points to alcohol as the most trustworthy remedy. Although some hold that alcohol in this condition is not indicated, I believe that it is in many instances the only remedy capable of tiding the patient over the most dangerous period. It should be given when the pulse becomes small, frequent, and feeble, or very compressible, and when the heart-sounds—particularly the second pulmonic sound—begin to lose their force. The amount will vary with the age of the patient and with his habits. Beginning with four to six ounces in the day the quantity may be increased, if necessary, to twelve or sixteen or even twenty ounces.

Of medicinal agents strychnine is one of the most valuable and has come into favor as a useful cardiac tonic. It may be given in doses of from a thirtieth to a twentieth of a grain. No certainty has as yet been reached as to the value of digitalis in the failing heart of fever. The practice is very general, but it is a drug to be used with caution in this condition. When there are signs of sudden or rapid heart-failure, hypodermic injections of ether will sometimes prove most serviceable. Of other stimulants ammonia is one of the most valuable and is best given in the form of the aromatic spirits, which is quite as satisfactory and much less nauseous than the usually administered carbonate of ammonia. Camphor and musk may also be employed.

Following the practice which is employed in spreading erysipelas, some writers have recommended direct antiseptic injections into the lung tissue itself. Lepine has used with benefit very dilute bichloride injections. In cases of gangrene following pneumonia, it might be of advantage to use iodoform oil or bichloride solutions.

The question of the use of arterial sedatives has not yet been settled. Aconite and veratrum viride and tartar emetic are largely used and loudly recommended by many physicians. I have never seen such benefit from

their early use as would warrant a recommendation, and when an arterial sedative is indicated in the robust, full-blooded, healthy individual, I much prefer the lancet.

Expectorants are rarely of any value in pneumonia. If any one wishes to be convinced of the futility of such remedies, let him study their action on a series of cases of sthenic pneumonia, in which it would be a real gain to loosen the cough and give to the sputa a certain degree of fluidity. Nor in the stage of resolution can they be said to be of any special service. In cases of tardy resolution I have not hesitated to use pilocarpine, as suggested by Riess.

For the distressing cough and the pain in the side, opium in some form may be given, either the hypodermic of morphia or, for the cough alone, Dover's powder. There has been a feeling in the profession that opium was counter-indicated in pneumonia, but I fully agree with Loomis that it may be given with safety and with the greatest comfort to the patient. With marked cerebral symptoms an ice-cap may be used. If there is delirium, the patient should be carefully watched. For these symptoms the cold bath is by far the most efficient remedy, and it or the cold pack should be resorted to without hesitation. For the complications, in the more serious ones, such as meningitis and endocarditis, but little can be done. Pleurisy with large effusion may require aspiration. If there is doubt as to the existence of fluid the exploratory needle should be used. It may be necessary, in pericarditis with extensive effusion, to aspirate the sac.

Careful feeding forms an essential part of the treatment. The diet should be light and made up of articles which, while nourishing, are not heavy and not apt to induce flatulency. Milk or milk-whey, broths, beef-juice, and eggs constitute the main articles of food. The starchy articles, as a rule, should be excluded, because they tend to induce flatulency. If the milk also has this effect, it is better to use the whey and egg-white or beef-juices. Before leaving the question of diet it may be mentioned that the use of cold drinks, such as soda or Apollinaris water, not only gives relief to the distressing thirst, but also helps to reduce the fever, and may diminish slightly the viscidity of the expectoration.

III. CHRONIC INTERSTITIAL PNEUMONIA

(Cirrhosis of Lung).

This consists in the gradual substitution to a greater or less extent of connective tissue for the normal lung. It is a fibroid change which may have its starting point in the tissue about the bronchi and blood-vessels, the interlobular septa, the alveolar walls, or in the pleura. So diverse are the different forms and so varied the conditions under which this change occurs that a proper classification is extremely difficult. We may recognize, however, two chief forms—the *local*, which involves only a limited

I give here for the benefit of those studying the symptomatology of Pneumonia a bibliography of the papers of Dr Wells of Chicago in which all the references are made readily

area of the lung substance, and the *diffuse*, invading either both lungs or an entire organ.

Etiology.—*Local* fibroid change in the lungs is common. It is a constant accompaniment of tubercle and in every case of phthisis the chronic interstitial changes play a very important *rôle*. In tumors, abscess, gummata, hydatids, and emphysema it also occurs. Fibroid processes are frequently met with at the apices of the lung and may be due either to a limited healed tuberculosis, to fibroid induration in consequence of pigment, or, in a few instances, may result from thickening of the pleura.

Diffuse Interstitial Pneumonia is met with under the following circumstances: 1. As a sequence of acute fibrinous pneumonia. Although extremely rare, this is recognized as a possible termination. From unknown causes resolution fails to take place. A gradual process of organization goes on in the fibrinous plugs within the air-cells and the alveolar walls become greatly thickened by a new growth, first of nuclear and subsequently fibrillated connective tissue. Macroscopically there is produced a smooth, grayish, homogeneous tissue which has the peculiar translucency of all new-formed connective tissue. This has been called gray induration. The subsequent history of this form needs more careful study. A majority of the cases terminate within a few months, and instances which have been followed from the outset are very rare.

In one of Charcot's cases, quoted by Bastian, death occurred about three months and a half after the onset of the acute disease and the lung was two thirds the normal size, grayish in color, and hard as cartilage. In the only case of the kind which has come under my observation, the patient died about a month from the onset of the chill. The lung was uniformly solid and grayish in color. In certain regions the fibrinous moulds in the air-cells were fatty, while in others there were areas of a grayish translucent aspect, firm, smooth, not at all granular, and resembling recent connective tissue. Microscopically, these areas showed advanced fibroid change and great thickening of the alveolar walls, while the fibrin plugs of the air-cells were undergoing fibroid transformation.

2. *Chronic Broncho-Pneumonia.*—The relation of broncho-pneumonia to cirrhosis of the lung has been specially studied by Charcot, who states that it may follow the acute or subacute form of this disease. The fibrosis extends from the bronchi, which are usually found dilated. The alveolar walls are thickened and the lobules converted into firm grayish masses, in which there is no trace of normal lung tissue. This process may go on and involve an entire lobe or even the whole lung. Many of these cases are tuberculous from the outset.

3. *Pleurogenous Interstitial Pneumonia.*—Charcot applies this term to that form of cirrhosis of the lung which follows invasion from the pleura. Doubt has been expressed by some writers whether this really occurs. While Wilson Fox is probably correct in questioning whether an

entire lung can become cirrhosed by the gradual invasion from the pleura, I think there can be no doubt that there are instances of primitive dry pleurisy, which, as Sir Andrew Clark has pointed out, gradually compresses the lung and at the same time leads to interstitial cirrhosis. This may be due in part to the fibroid change which follows prolonged compression. In some cases there seems to be a distinct connection between the greatly thickened pleura and the dense strands of fibrous tissue passing from it into the lung substance. Instances occur in which one lobe or the greater part of it presents, on section, a mottled appearance, owing to the increased thickness of the interlobular septa—a condition which may exist without a trace of involvment of the pleura. In many other cases, however, the extension seems to be so definitely associated with pleurisy that there is no doubt as to the causal connection between the two processes. In these instances the lung is removed with great difficulty, owing to the thickness and close adhesion of the pleura to the chest wall.

4. *Chronic Interstitial Pneumonia*, due to inhalation of dust. Zenker has proposed the term *pneumonokoniosis* for the group of diseases due to the irritating effects of dust in certain occupations, such as coal-mining, stone-cutting, axe-grinding, and working in iron dust. It is essentially a chronic broncho-pneumonia leading to fibroid induration, at first nodular and peribronchial, and finally involving large areas of the lung tissue, which are converted into dense grayish-brown or black masses. The subject will receive separate consideration.

The term cirrhosis should be limited strictly to those cases in which a lung is involved in the fibroid process, whether originating in the parenchyma or in the pleura. It should not be applied to fibroid phthisis of tuberculous origin.

Morbid Anatomy.—The disease is unilateral; the chest of the affected side is sunken, deformed, and the shoulder much depressed. On opening the thorax the heart is seen drawn far over to the affected side. The unaffected lung is emphysematous and covers the greater portion of the mediastinum. It is scarcely credible in how small a space, close to the spine, the cirrhosed lung may lie. Indeed, it may be overlooked, as happened in the case of a physician of my acquaintance, who left instructions that his lung should be sent to Palmer Howard, of Montreal. It was reported, however, that at the autopsy no lung could be found! The adhesions between the pleural membranes may be extremely dense and thick, particularly in the pleurogenous cases; but when the disease has originated in the lung there may be little thickening of the pleura. The organ is airless, firm, and hard. It strongly resists cutting, and on section shows a grayish fibroid tissue of variable amount, through which pass the blood-vessels and bronchi. The latter may be either slightly or enormously dilated. There are instances in which the entire lung is converted into a series of bronchiectatic cavities and the cirrhosis is apparent only in certain areas or at the root. The tuberculous cases can usually be

differentiated by the presence of an apical cavity, not bronchiectatic, and often large; and the other lung almost invariably shows tuberculous lesions. There are cases in which it is difficult to determine satisfactorily the true nature. A question of some interest in connection with chronic interstitial pneumonia is, Do softening and cavity formation ever occur apart from caseation and tuberculosis? That is to say, are there cavities in a cirrhotic lung which may be due to a simple necrosis? Undoubtedly, though they are rare; I have seen them in at least two instances of anthracosis, and Charcot* refers to them as "*ulcères du poumon*," to distinguish them from the abscess cavity of acute pneumonia or a tuberculous cavity. The other lung is always greatly enlarged and emphysematous. The heart is hypertrophied, particularly the right ventricle, and there may be marked atheromatous changes in the pulmonary artery. An amyloid condition of the viscera is found in some cases.

Symptoms and Course.—It is essentially a chronic disease, extending over a period of many years, and when once the condition is established the health may be fairly good. In a well-marked case the patient complains only of his chronic cough, perhaps of slight shortness of breath. In other respects he is quite well, and is usually able to do light work. The cases are commonly regarded as phthisical, though there may be scarcely a symptom of that affection except the cough. There are instances, however, of fibroid phthisis which cannot be distinguished from cirrhosis of the lung except by the presence of tubercle bacilli in the expectoration. As the bronchi are usually dilated, the symptoms and physical signs may be those of bronchiectasis. The cough is paroxysmal and the expectoration is generally copious and of muco-purulent or sero-purulent nature. It is sometimes fetid. Hæmorrhage is by no means infrequent, and occurred in more than one half of the cases analyzed by Bastian. Walking on the level and in the ordinary affairs of life the patient may show no shortness of breath, but in the ascent of stairs and on exertion there may be dyspnœa.

Physical Signs.—*Inspection.*—The affected side is immobile, retracted, and shrunken, and contrasts in a striking way with the voluminous sound side. The intercostal spaces are obliterated and the ribs may even overlap. The shoulder is drawn down and from behind it is seen that the spine is bowed. The heart is greatly displaced, being drawn over by the shrinkage of the lung to the affected side. When the left lung is affected there may be a large area of visible impulse in the second, third, and fourth interspaces. Mensuration shows a great diminution in the affected side, and with the saddle-tape the expansion may be seen to be negative. The *percussion* note varies with the condition of the bronchi. It may be absolutely dull, particularly at the base or at the apex. In the axilla there may be a flat tympany or even an amphoric note over a large

* Œuvres complètes de J. M. Charcot, tome v, p. 189.

sacculated bronchus. On the opposite side the percussion note is usually hyperresonant. On *auscultation* the breath-sounds have either a cavernous or amphoric quality at the apex, and at the base are feeble, with mucous, bubbling râles. The voice-sounds are usually exaggerated. Cardiac murmurs are not uncommon, particularly late in the disease, when the right heart fails. These are, of course, the physical signs of the disease when it is well established. They naturally vary considerably, according to the stage of the process. The disease is essentially chronic, and may persist for fifteen or twenty years. Death occurs sometimes from hæmorrhage, more commonly from gradual failure of the right heart with dropsy, and occasionally from amyloid degeneration of the organs.

The *diagnosis* is never difficult. It may be impossible to say, without a clear history, whether the origin is pleuritic or pneumonic. Between cases of this kind and fibroid phthisis it is not always easy to discriminate, as the conditions may be almost identical. When tuberculosis is present, however, even in long-standing cases, bacilli are usually present in the sputa, and there may be signs of disease in the other lung.

Treatment.—It is only for an intercurrent affection or for an aggravation of the cough that the patient seeks relief. Nothing can be done for the condition itself. When possible the patient should live in a mild climate, and should avoid exposure to cold and damp. A distressing feature in some cases is the putrefaction of the contents of the dilated tubes, for which the same measures may be used as in fetid bronchitis.

IV. BRONCHO-PNEUMONIA (*Capillary Bronchitis*).

This is essentially an inflammation of the terminal bronchus and the air-vesicles which make up a pulmonary lobule, whence the term broncho-pneumonia. It is also known as lobular, in contradistinction to lobar pneumonia. The term catarrhal is less applicable. The process begins in all cases with an inflammation of the capillary bronchi, which is a condition rarely if ever found without involvement of the lobular structures, so that it is now customary to consider the affections together.

Etiology.—Broncho-pneumonia is as a rule a secondary affection met with under the following circumstances:

1. As a sequence of the infectious fevers—measles, diphtheria, whooping-cough, scarlet fever, and, less frequently, small-pox, erysipelas, and typhoid fever. In children it forms the most serious complication of these diseases, and in reality causes more deaths than are due directly to the fevers.* In large cities it ranks next in fatality to infantile diarrhœa. Following, as it does, the contagious diseases which principally affect children, we find that a large majority of cases occur during early life.

* Cyclopædia of the Diseases of Children, vol. ii.

An inspiration broncho-pneumonia may follow haemoptysis, which has been already considered the aspiration of material from a bronchiectatic cavity, and occasionally the material from an empyema which has ruptured into the lung.

According to Morrill's Boston statistics, it is most fatal during the first two years of life. The number of cases in a community increases or decreases with the prevalence of measles, scarlet fever, and diphtheria. It is most prevalent in the winter and spring months. In the febrile affections of adults broncho-pneumonia is not very common. Thus in typhoid fever it is not so frequent as lobar pneumonia, though isolated areas of consolidation at the bases are by no means rare in protracted cases of this disease. In old people it is an extremely common affection, following debilitating causes of any sort, and supervening in the course of chronic Bright's disease and various acute and chronic maladies.

2. In the second division of this affection are embraced the cases of so-called aspiration or deglutition pneumonia. Whenever the sensitiveness of the larynx is benumbed, as in the coma of apoplexy or uræmia, minute particles of food or drink are allowed to pass the *rima*, and, reaching finally the smaller tubes, excite an intense inflammation similar to the vagus pneumonia which follows the section of the pneumogastrics in the dog. Cases are very common after operations about the mouth and nose, after tracheotomy, and in cancer of the larynx and œsophagus. The aspirated particles in some instances induce such an intense broncho-pneumonia that suppuration or even gangrene supervenes.

3. The most common and fatal form of broncho-pneumonia is that excited by the tubercle bacillus, which has already been considered.

Among general predisposing causes may be mentioned age. As just noted, it is prone to attack infants, and a majority of cases of pneumonia in children under five years of age are of this form. At the opposite extreme of life it is also common, particularly in association with various debilitating circumstances and chronic diseases incident to the old. In children rickets and diarrhœa are marked predisposing causes, and broncho-pneumonia is one of the most frequent post-mortem-room lesions in infants' homes and foundling asylums. The disease prevails more extensively among the poorer classes, because their children are of necessity more exposed and cannot have the needful care and nursing, particularly after eruptive fevers.

Morbid Anatomy.—In the lungs of a child dead of broncho-pneumonia, after measles or diphtheria, the appearances are very characteristic. On the pleural surfaces, particularly toward the base, are seen depressed bluish or blue-brown areas of collapse, between which the lung tissue is of a lighter color. Here and there are projecting portions over which the pleura may be slightly turbid or granular. The lung is fuller and firmer than normal, and, though in great part crepitant, there can be felt in places throughout the substance solid, nodular bodies. The dark depressed areas may be isolated or a large section of one lobe may be in the condition of collapse or atelectasis. Gradual inflation by a blow-pipe inserted in the bronchus will distend a great majority of these collapsed areas. On section, the general surface has a dark reddish color and usu-

ally drips blood. Projecting above the level of the section are lighter red or reddish-gray areas representing the patches of broncho-pneumonia. These may be isolated and separated from each other by tracts of uninflamed tissue or they may be in groups or the greater part of a lobe may be involved. Study of a favorable section of an isolated patch shows: (*a*) A dilated central bronchiole full of tenacious purulent mucus. A fortunate section parallel to the long axis may show a racemose arrangement—the alveolar passages full of muco-pus. (*b*) Surrounding the bronchus for from 3 to 5 mm. or even more is an area of grayish-red consolidation, usually elevated above the surface and firm to the touch. Unlike the consolidation of lobar pneumonia, it may present a perfectly smooth surface, though in some instances it is distinctly granular. In a late stage of the disease small grayish-white points may be seen, which on pressure may be squeezed out as purulent droplets. A section in the axis of the lobule may present a somewhat grape-like arrangement, the stalk and stems representing the bronchioles and alveolar passages filled with a yellowish or grayish-white pus, while surrounding them is a reddish-brown hepatized tissue. (*c*) In the immediate neighborhood of this peribronchial inflammation the tissue is dark in color, smooth, airless, at a somewhat lower level than the hepatized portion, and differs distinctly in color and appearance from the other portions of the lung. This is the condition to which the term *splenization* has been given. It really represents a tissue in the early stage of inflammation, and it perhaps would be as well to give up the use of this term and also that of *carnification*, which is only a more advanced stage. The condition of collapse probably always precedes this, and it is difficult in some instances to tell the difference, as one shades into the other. In fact, collapse, splenization, and carnification may be said in broncho-pneumonia to be steps preliminary to the condition of actual hepatization.

While, in many cases, the areas of broncho-pneumonia present a reddish-brown color and are indistinctly granular, in others, particularly in adults, the nodules may resemble more closely gray hepatization and the air-cells are filled with a grayish, muco-purulent material. Minute hæmorrhages are sometimes seen in the neighborhood of the inflamed areas or on the pleural surfaces. Emphysema is commonly seen at the anterior borders and upper portions of the lung or in lobules adjacent to the inflamed ones. In many cases following diphtheria and measles the process is so extensive that the greater part of a lobe is involved, and it looks like a case of lobar hepatization. It has not, however, the uniformity of this affection and collapsed dark strands may be seen between extensive areas of hepatized tissue.

Practically, in the morbid anatomy of broncho-pneumonia in children we may recognize three groups of cases: (1) Those in which the bronchitis and bronchiolitis are most marked and in which there may be no definite consolidation and yet on microscopical examination many of the

alveolar passages and adjacent air-cells appear filled with inflammatory products. (2) The disseminated broncho-pneumonia, in which there are scattered areas of peribronchial hepatization with patches of collapse, while a considerable proportion of the lobe is still crepitant. This is by far the most common condition. (3) Pseudo-lobar form, in which the greater portion of the lobe is consolidated, but not uniformly, for intervening strands of dark congested lung tissue separate the groups of hepatized lobules.

In the secondary broncho-pneumonia of adults, it is generally the disseminated form which is seen.

Microscopically, a cross section of a small broncho-pneumonic focus shows the following changes: In the centre is a bronchus filled with a plug of exudation, consisting of leucocytes and swollen epithelium. Section in the long axis may show irregular dilatations of the tube. The bronchial wall is swollen and infiltrated with cells. Under a low power it is readily seen that the air-cells next the bronchus are most densely filled, while toward the periphery of the focus the alveolar exudation becomes less. The contents of the air-cells are made up of leucocytes and swollen endothelial cells in varying proportion. Red corpuscles are not often present and a fibrin network is rarely seen, though it may be present in some alveoli. In the swollen walls are seen distended capillaries and numerous leucocytes. As Delafield has pointed out, the interstitial inflammation of the bronchi and alveolar walls is a special feature of broncho-pneumonia which distinguishes it from the ordinary croupous form.

The histological changes in the aspiration or deglutition broncho-pneumonia differ from the ordinary post-febrile form in a more intense infiltration of the air-cells with leucocytes, producing suppuration and foci of softening, and even tending to gangrene.

Broncho-pneumonia may terminate (1) in *resolution*, which when it once begins goes on more rapidly than in fibrinous pneumonia. Broncho-pneumonia of the apices, in a child, persisting for three or more weeks, particularly if it follows measles or diphtheria, is often tuberculous. In these instances, when resolution is supposed to be delayed, caseation has in reality taken place. (2) In *suppuration*, which is rarely seen apart from the aspiration and deglutition forms, in which it is extremely common. (3) In *gangrene*, which occurs under the same conditions. (4) In *fibroid changes—chronic broncho-pneumonia*—a rare termination in the simple, a common sequence of the tuberculous disease. Formerly it was thought that one of the most common changes in broncho-pneumonia, particularly in children, was caseation; but this is really a tuberculous process, the natural termination of an originally specific broncho-pneumonia. It is of course quite possible that a broncho-pneumonia, simple in its origin, may subsequently be the seat of infection by the *bacillus tuberculosis*.

Symptoms.—Much confusion has arisen from the description of capillary bronchitis as a separate affection, whereas it is only a part, though a primary and important one, of broncho-pneumonia. At the outset it may be said that if in convalescence from measles or in whooping-cough a child has an accession of fever with cough, rapid pulse, and rapid breathing, and if, on auscultation, fine râles are heard at the bases, or widely spread throughout the lungs, even though neither consolidation nor blowing breathing can be detected, the diagnosis of broncho-pneumonia may safely be made. I have never seen in a fatal case after diphtheria or measles a capillary bronchitis as the sole lesion. The onset is rarely sudden, or with a distinct chill; but after a day or so of indisposition the child gets feverish and begins to cough and to get short of breath. The fever is extremely variable; a range of from 102° to 104° is common. The skin is very dry and pungent. The cough is hard, distressing, and may be painful. Dyspnœa gradually becomes a prominent feature. Expiration may be jerky and grunting. The respirations may rise as high as 60 or even 80 in the minute. Within the first forty-eight hours the percussion resonance is not impaired; the note, indeed, may be very full at the anterior borders of the lungs. On auscultation, many râles are heard, chiefly the fine subcrepitant variety, with sibilant rhonchi. There may really be no signs indicating that the parenchyma of the lung is involved, and yet even at this early stage, within forty-eight hours of the onset of the pulmonary symptoms, I have repeatedly, after diphtheria, found scattered nodules of lobular hepatization. Northrup,* in his thorough article on the subject, notes a case in which death occurred within the first twenty-four hours, and, in addition to the extensive involvement of the smaller bronchi, the intralobular tissue also was involved in places. The dyspnœa is constant and progressive and soon signs of deficient aëration of the blood are noted. The face becomes a little suffused and the finger-tips bluish. The child has an anxious expression and gradually enters upon the most distressing stage of asphyxia. At first the urgency of the symptoms is marked, but soon the benumbing influence of the carbon dioxide on the nerve-centres is seen and the child no longer makes strenuous efforts to breathe. The cough subsides and, with a gradual increase in lividity and a drowsy restlessness, the right ventricle becomes more and more distended, the bronchial râles become more liquid as the tubes fill with mucus, and death occurs from heart paralysis. These are the symptoms of a severe case of broncho-pneumonia, or what the older writers called *suffocative catarrh.*

The *physical signs* may at first be those of capillary bronchitis, as indicated by the absence of dulness, the presence of fine subcrepitant and whistling râles. In many cases death takes place before any definite pneumonic signs are detected. When these exist they are much more frequent

* Reference Handbook of the Medical Sciences, art. Broncho-Pneumonia.

at the bases, where there may be areas of impaired resonance or even of positive dulness. When numerous foci involve the greater part of a lobe the breathing may become tubular, but in the scattered patches of ordinary broncho-pneumonia, following the fevers, the breathing is more commonly harsh than blowing. In grave cases there is retraction of the base of the sternum and of the lower costal cartilages during inspiration, pointing to deficient lung expansion.

Diagnosis.—With lobar pneumonia it may readily be confounded if the areas of consolidation are large and merged together. It is to be remembered that broncho-pneumonia occurs chiefly in children under five years of age, whereas lobar pneumonia in children is much more common between the ages of five and fifteen. No writer has so clearly brought out the difference between pneumonia at these periods as Gerhard,* of Philadelphia, whose papers on this subject, though published nearly sixty years ago, have the freshness and accuracy which characterize all the writings of that eminent physician. Holt has recently brought forward figures to show that lobar pneumonia is not infrequent in infants under two years of age. The mode of onset is essentially different in the two affections, the one developing insidiously in the course or at the conclusion of another disease, the other setting in abruptly in a child in good health. In lobar pneumonia the disease is almost always unilateral, in broncho-pneumonia bilateral. The chief trouble arises in cases of broncho-pneumonia, which by aggregation of the foci involves the greater part of one lobe. Here the difficulty is very great, and the physical signs may be practically identical, but in a broncho-pneumonia it is much more likely that a lesion will be found on the other side. The course of the two affections is very unlike; the lobar pneumonia in children terminates on the eighth or tenth day with abruptness, as in adults.

A still more difficult question to decide is whether an existing broncho-pneumonia is simple or tuberculous. In many instances the decision cannot be made, as the circumstances under which the disease occurs, the mode of onset, and the physical signs may be identical. It has often been my experience that a case has been sent down from the children's ward to the dead-house with the diagnosis of post-febrile broncho-pneumonia in which there was no suspicion of the existence of tuberculosis; but on section there were found tuberculous bronchial glands and scattered areas of broncho-pneumonia, some of which were distinctly caseous, while others showed signs of softening. I have already spoken fully of this in the section on tuberculosis, but it is well to emphasize the fact that there are many cases of broncho-pneumonia in children which time alone enables us to distinguish from tuberculosis. The existence of extensive disease at the apices or central regions is a suggestive indication, and signs of softening may be detected. In the vomited matter, which is brought

* American Journal of the Medical Sciences, vols. xiv and xv.

up after severe spells of coughing, sputum may be picked out and elastic tissue and bacilli detected.

It is a superfluous refinement to make a diagnosis between capillary bronchitis and catarrhal pneumonia, for the two conditions are part and parcel of the same disease. In simple bronchitis involving the larger tubes urgent dyspnœa and pulmonary distress are rarely present and the râles are coarser and more sibilant. It must not be forgotten that, as in lobar pneumonia, cerebral symptoms may mask the true nature of the disease, and may even lead to the diagnosis of meningitis. I recall more than one instance in which it could not be satisfactorily determined whether the infant had tuberculous meningitis or a cerebral complication of an acute pulmonary affection.

Prognosis.—In children enfeebled by constitutional disease and prolonged fevers broncho-pneumonia is terribly fatal, but in cases coming on in connection with whooping-cough or after measles recovery may take place in the most desperate cases. It is in this disease that the truth of the old maxim is shown—"Never despair of a sick child." The death-rate in children under five has been variously estimated at from thirty to fifty per cent. After diphtheria and measles thin, wiry children seem to stand broncho-pneumonia much better than fat, flabby ones. In adults the aspiration or deglutition pneumonia is a very fatal disease.

Prophylaxis.—Much can be done to reduce the probability of attack after febrile affections. Thus, in the convalescence from measles and whooping-cough, it is very important that the child should not be exposed to cold, particularly at night, when the temperature of the room naturally falls. In a nocturnal visit to the nursery—sometimes, too, I am sorry to say, to a children's hospital—how often one sees children almost naked, having kicked aside the bedclothes and having the night-clothes up about the arms! The use of light flannel "combinations" obviates this nocturnal chill, which is, I am sure, an important factor in the colds and pulmonary affections of young children, both in private houses and in institutions. The catarrhal troubles of the nose and throat should be carefully attended to, and during fevers the mouth should be washed two or three times a day with an antiseptic solution.

Treatment.—The frequency and the seriousness of broncho-pneumonia render it a disease which taxes to the utmost the resources of the practitioner. There is no acute pulmonary affection over which he at times so greatly despairs. On the other hand, there is not one in which he will be more gratified in saving cases which have seemed past all succor. The general arrangements should receive special attention. The room should be kept at an even temperature—about 65° to 68°—and the air should be kept moist with vapor.

At the outset the bowels should be opened by a mild purge, either castor oil or small doses of calomel, one twelfth to one sixth of a grain hourly until a movement is obtained, and care should be taken throughout

the attack to secure a daily movement. The common saline fever mixture of citrate of potash, liquor ammoniæ acetatis, and aromatic spirits of ammonia may be given every two or three hours. If the disease comes on abruptly with high fever, minim or minim and a half doses of the tincture of aconite may be given with it. The pain, the distressing symptoms, and the incessant cough often demand opium, which must of course be used with care and judgment in the case of young children, but which is certainly not contra-indicated and may be usefully given in the form of Dover's powder. Blisters are now rarely if ever employed, and even the jacket poultice has gone out of fashion. For the latter, however, I confess to a strong prejudice, and when lightly made and frequently changed it undoubtedly gives great relief. Much more commonly we now see, both in private and in hospital practice, the jacket of cotton-batting. Ice-poultices to the chest I have seen used apparently with great benefit, and they are warmly recommended by many German physicians as well as by Goodhart and others in England. The diet should consist of milk, broths, and egg albumen. Milk often curds and is disagreeable. Egg-white is particularly suitable and very acceptable when given in cold water with a little sugar. It forms, indeed, an excellent medium for the administration of the stimulants. If the pulse shows signs of failing, it is best to begin early with brandy. As in all febrile affections of children, cold water should be constantly at the bedside, and the child should be encouraged to drink freely. With these measures, in many cases the disease progresses to a favorable termination, but too often other and more serious symptoms arise. Cough becomes more distressing, dyspnœa increases, the ominous rattling of the mucus can be heard in the tubes, the child's color is not so good, and there is greater restlessness. Under these circumstances stimulant expectorants—ammonia, squills, and senega—should be given. Together they make a very disagreeable dose for a young child, particularly with the carbonate of ammonia. The aromatic spirits of ammonia is somewhat better. If the carbonate is employed, it must be given in small doses, not more than a grain to an infant of eighteen months. If the child has increasing difficulty in getting up the mucus, an emetic should be given—either the wine of ipecac or, if necessary, tartar emetic. There is no necessity, however, to keep the child constantly nauseated. Enough should be given to cause prompt emesis, and the benefit results in the expulsion of mucus from the larger tubes. In this stage, too, strychnine is undoubtedly helpful in stimulating the depressed respiratory centre. With commencing cyanosis, inhalations of oxygen may be employed, sometimes with great benefit.

With rapid failure of the heart, loud mucous rattles in the throat, and increasing lividity, every measure should be used to arouse the child and excite coughing. Alternate douches of hot and cold water, electricity, which I have seen applied with good results at Wiederhofer's clinic in Vienna, and hypodermic injections of ether may be tried. For the reduc-

tion of temperature, particularly if cerebral symptoms are prominent, there is nothing so satisfactory as the wet pack or the cold bath. In the case of children, when the latter is used it should be graduated, beginning with a temperature which is pleasantly warm and gradually reducing it to 75° or 80°. Even when the temperature is not high, the cerebral symptoms are greatly relieved by the bath or the pack.

V. EMPHYSEMA.

Rupture of superficial vesicles may produce pneumothorax. In the case of deep-seated alveoli the air escapes into the interlobular connective tissue and causes a condition comparable to ordinary subcutaneous emphysema. It is not a very serious condition and rarely produces symptoms. It usually results from violent expiratory efforts, as in whooping-cough. The air-bubbles escape into the interlobular tissue, in which they look like little rows of beads, and when extensive, the lobules are distinctly outlined by them (interstitial emphysema). There may be large bullæ beneath the pleura. A very rare event is the rupture close to the root of the lung and the passage of air along the trachea into the subcutaneous tissues of the neck.

The condition in which the infundibular passages and the alveoli are dilated is called *vesicular emphysema.*

A practical division may be made into compensatory, hypertrophic, and atrophic forms.

I. Compensatory Emphysema.

Whenever a region of the lung does not expand fully in inspiration, either another portion of the lung must expand or the chest wall sink in order to occupy the space. The former almost invariably occurs. We have already mentioned that in broncho-pneumonia there is a vicarious distention of the air-vesicles in the adjacent healthy lobules, and the same happens in the neighborhood of tuberculous areas and cicatrices. In general pleural adhesions there is often compensatory emphysema, particularly at the anterior margins of the lung. The most advanced example of this form is seen in cirrhosis, when the unaffected lung increases greatly in size, owing to distention of the air-vesicles. A similar though less marked condition is seen in extensive pleurisy with effusion and in pneumothorax.

At first, this distention of the air-vesicles is a simple physiological process and the alveolar walls are stretched but not atrophied. Ultimately, however, in many cases they waste and the contiguous air-cells fuse, producing true emphysema.

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THE PRINCIPLES AND PRACTICE OF MEDICINE

DESIGNED FOR

THE USE OF PRACTITIONERS AND STUDENTS OF MEDICINE

BY

WILLIAM OSLER, M. D.

Fellow of the Royal College of Physicians, London; Professor of Medicine in the Johns Hopkins University and Physician-in-Chief to the Johns Hopkins Hospital, Baltimore; formerly Professor of the Institutes of Medicine, McGill University, Montreal; and Professor of Clinical Medicine in the University of Pennsylvania, Philadelphia

Sold only by Subscription

PRICES

CLOTH, $5.50; SHEEP, $6.50; HALF MOROCCO, $7.00

D. APPLETON & CO., Publishers

1, 3, & 5 BOND STREET, NEW YORK

THE publishers take a pardonable pride in presenting this, the latest, most modern text-book of practice, to the profession.

Written, as it has been, from the standpoint of a long and practical experience—an experience that has kept its author constantly abreast of the advances in medicine—it stands to-day as the practical exponent of modern methods and modern medicine. The author, Dr. Osler, is too well known as a teacher, clinician, and writer, to require any introduction to the profession of either America or Europe. While his connection with the leading hospitals and medical colleges of both continents has given him an international reputation, it has endowed him with a particular fitness for the task of preparing a text-book of practice which is, in its essential features, an ideal work on the subject.

The classifications which he adopts can best be understood by means of the following sketch, or analysis, to which is added the number of pages devoted to each chief division :

The FIRST SECTION of the work has for its title SPECIFIC INFECTIOUS DISEASES, and includes

Typhoid fever, typhus fever, relapsing fever, small-pox, vaccinia, varicella, scarlet fever, measles, rubella, epidemic parotitis, whooping-cough, influenza, dengue, cerebro-spinal meningitis, diphtheria, erysipelas, septicæmia and pyæmia, Asiatic cholera, yellow fever, dysentery, malarial fever, anthrax, rabies, tetanus, syphilis, tuberculosis, leprosy, glanders, actinomycosis;

While under the head of INFECTIOUS DISEASES OF DOUBTFUL NATURE are classed

Ephemeral fever, Weil's disease, milk-sickness, Malta fever, mountain fever, and miliary fever. (*269 pages.*)

CONSTITUTIONAL DISEASES is the title of the SECOND SECTION, and they embrace

Rheumatic fever, chronic rheumatism, pseudo-rheumatic affections, muscular rheumatism, arthritis deformans, gout, diabetes mellitus, diabetes insipidus, rickets, scurvy, purpura, and hæmophilia. (*53 pages.*)

The THIRD SECTION of the work, entitled DISEASES OF THE DIGESTIVE SYSTEM, embraces

Stomatitis, diseases of the salivary glands, diseases of the pharynx, diseases of the tonsils (acute and chronic), diseases of the œsophagus (including acute œsophagitis, spasm of the œsophagus, stricture, cancer, rupture, and dilatations), diseases of the stomach (with methods of clinical examination), acute gastritis, chronic gastritis, neuroses of the stomach, dilatation of the stomach, peptic ulcer (gastric and duodenal), cancer of the stomach, and hæmorrhage from the stomach.

Then follow DISEASES OF THE INTESTINES, including

Catarrhal enteritis, diarrhœa, enteritis in children, diphtheritic or croupous enteritis, phlegmonous enteritis, mucous colitis, ulcerative enteritis, miscellaneous affections of the bowels, appendicitis, intestinal obstruction, and constipation.

Under the heading DISEASES OF THE LIVER are

Jaundice (in its various forms), affections of the blood-vessels of the liver, diseases of the bile-passages, cirrhosis, abscess of the liver, new growths in the liver, fatty liver, and amyloid liver.

DISEASES OF THE PANCREAS include

Hæmorrhage, chronic pancreatitis, pancreatic cysts, and cancer.

DISEASES OF THE PERITONÆUM take in

Acute general peritonitis, peritonitis in infants, localized peritonitis, chronic peritonitis, new growths in the peritonæum, and ascites. (*150 pages.*)

The FOURTH SECTION of the work, under the heading DISEASES OF THE RESPIRATORY SYSTEM, includes

Acute coryza, chronic nasal catarrh, autumnal catarrh and epistaxis.

DISEASES OF THE LARYNX embrace

Acute catarrhal laryngitis, chronic laryngitis, œdematous laryngitis, membranous laryngitis, spasmodic laryngitis, tuberculous laryngitis and syphilitic laryngitis.

DISEASES OF THE BRONCHI include

Acute bronchitis, chronic bronchitis, bronchiectasis, bronchial asthma, and fibrinous bronchitis.

The subdivisions under DISEASES OF THE LUNGS are

Circulatory disturbances of the lungs, pneumonia, chronic interstitial pneumonia, broncho-pneumonia, emphysema, gangrene of the lung, abscess of the lung, pneumonokoniosis, and new growths in the lungs.

DISEASES OF THE PLEURA are treated under the sub-headings of

Acute pleurisy (in its various forms), chronic pleurisy, hydrothorax, and pneumothorax.

This is followed by a short section on DISEASES OF THE MEDIASTINUM. (*106 pages.*)

The FIFTH SECTION of the work is devoted to DISEASES OF THE CIRCULATORY SYSTEM, beginning with those of the pericardium, which include

Pericarditis and other affections of the pericardium.

Under DISEASES OF THE HEART are

Endocarditis, chronic valvular disease, hypertrophy and dilatation, affections of the myocardium, neuroses of the heart, and congenital affections of the heart.

DISEASES OF THE ARTERIES embrace

Degenerations, arterio-sclerosis, and aneurysm. (*102 pages.*)

The SIXTH SECTION is on the DISEASES OF THE BLOOD AND DUCTLESS GLANDS, and includes

Anæmia, lukæmia, Hodgkin's disease, Addison's disease, and diseases of the thyreoid gland. (*32 pages.*)

The SEVENTH SECTION of the work takes up DISEASES OF THE KIDNEYS, and includes

Anomalies in form and position, circulatory disturbances, uræmia, Bright's disease (acute and chronic), amyloid disease, pyelitis, hydronephrosis, nephrolithiasis, tumors of the kidney, cystic disease of the kidney, and perinephric abscess. (*67 pages.*)

The EIGHTH SECTION is on DISEASES OF THE NERVOUS SYSTEM, the first subdivision being on DISEASES OF THE NERVES, including

Neuritis, neuromata, diseases of the cranial nerves, and diseases of the spinal nerves.

The second division is on DISEASES OF THE SPINAL CORD, embracing

Affections of the meninges, affections of the blood-vessels, and acute and chronic affections of the spinal cord.

The third division takes up DISEASES OF THE BRAIN, including

Affections of the meninges, affections of the blood-vessels, affections of the substance, hemiplegia and diplegia in children, sclerosis of the brain, chronic diffuse meningo-encephalitis, tumors of the brain, and chronic hydrocephalus.

The fourth division is on GENERAL AND FUNCTIONAL DISEASES, and deals with

Acute delirium, paralysis agitans, acute chorea, other affections described as chorea, infantile convulsions, epilepsy, migraine, neuralgia, professional spasms, occupation neuroses, tetany, hysteria, neurasthenia, the traumatic neuroses, and other forms of functional paralysis.

The fifth division includes

Raynaud's disease, angio-neurotic œdema, facial hemi-atrophy, acromegalia, and scleroderma. (*219 pages.*)

The NINTH SECTION is on DISEASES OF THE MUSCLES, including

Myositis, idiopathic muscular atrophy, Thomsen's disease, and paramyoclonus multiplex. (*6 pages.*)

The TENTH SECTION treats of INTOXICANTS, SUN-STROKE, OBESITY, and embraces

Alcoholism, morphine habit, lead poisoning, arsenical poisoning, ptomaine poisoning, grain poisoning, sun-stroke, and obesity. (*21 pages.*)

The ELEVENTH SECTION takes up the DISEASES DUE TO ANIMAL PARASITES, and embraces

Psorospermiasis, distomiasis, diseases caused by nematodes, diseases caused by cestodes, parasitica arachnida, parasitic insects, and pseudo-parasites.

(*33 pages.*)

Thus it is shown that the author has, in covering the domain of diseases, devoted to each class space commensurate to its importance and the state of existing knowledge. As an example of the thoroughness with which the subjects are treated, may be taken the article on tuberculosis, to which 73 pages are devoted; all of the forms in which the disease manifests itself are considered in the light of modern knowledge. The bacillus, which, in its various forms, plays such an important part in many diseases, is given due prominence here, as it is throughout the work.

The work is offered to the profession with the belief that it will be found to supply a hitherto existing gap in the literature of medicine.

Miss E. Edwards, who has been Sister-in-Charge of the Theatres since April, 1908, left the hospital on September 2nd, and Miss K. L. Hickman, who has just completed her training, was appointed to succeed her as Sister-in-Charge of the Theatres.

Miss Alice M. Hart, who completed her training in January last, and has since been acting as Staff Nurse, was appointed Medical Night Sister on September 21st.

Miss José Pagan, who has been Sister-in-Charge of Mary Ward since October, 1908, left the hospital on September 29th on appointment to Queen Alexandra's Military Nursing Service for India.

On August 6th, Nurse Ottley left the hospital on completion of her three years' training, and Probationer Nelson was appointed to succeed her as Head Nurse in Job Ward.

On August 17th, Nurse La Touche left the hospital on completion of her three years' training, and Probationer Fisher was appointed to succeed her as Head Nurse in Lazarus Ward.

On August 20th, Nurse Hancock left the hospital on completion of her three years' training, and Probationer Leigh was appointed to succeed her as Head Nurse in Luke Ward.

Staff Nurse in the Massage Department and Victoria Ward, left the hospital to take up the appointment of Out-Patient Sister at the Hospital for Children, Shadwell.

On September 26th, Nurse Rooke, Head Nurse in Naaman, and Nurse Murphy, Head Nurse in the Out-Patient Department, left the hospital on completion of their three years' training.

Presentations to Miss Swift.

On her departure from Guy's Hospital, Miss S. A. Swift received the following gifts from those who at different times had worked under her during the nineteen years she was connected with the hospital. A green crocodile dressing-case with ivory brushes and silver fittings from the present Sisters, Nurses, and Administrative Staff; and after a special meeting of the Council of the Past and Present Nurses' League, held on September 20th, Mrs. Cosmo Bonsor, the president, Mrs. C. H. Fagge, the hon. treasurer, and Mrs. Forsyth, the Past Nurses' representative, on behalf of the members, presented Miss Swift with a cheque from the Private Nursing Staff of the Institution and members of the Nurses' League. An address in an illuminated album, containing over 750 signatures of past and present nurses, is also in course of preparation.

Sweet, A. S. Vallack and Miss Grace F. Robinson.

THE hospital at Nymagee has been closed.

E. THOMAS, a medical agent in Sydney, sued Dr. F. W. Kane, of Newcastle, in the Metropolitan District Court on March 9, claiming a fee of 20 guineas for alleged services rendered in connection with his appointment as Medical Officer of the Newcastle United Friendly Societies' Dispensary. Both the President and the Secretary of the Dispensary stated in Court that Dr. Kane was appointed solely on the recommendation of Mr. Bruck, through whom all previous medical officers had been engaged; and it was also shown that the usual agent's commission in such cases was three guineas. However, as it appeared that Dr. Kane had agreed to pay Thomas the sum of £10 for including his name in a list of applicants, which Thomas had sent to the committee in Newcastle, the Judge had to give a verdict for £10 in favour of the plaintiff on the first count, and for the defendant on the second count.

DR. BADHAM, son of the late Professor Badham, of the Sydney University, has commenced practice at Mossman's Bay, near Sydney.

DRS. BARBER and SCOTT have been appointed Visiting Medical Officers of the Nepean Cottage Hospital at Penrith in the place of Dr. Shand.

DR. H. T. BURY has commenced practice at Junee.

DR. H. M. C. DALTON, formerly of Condobolin, has succeeded to the practice of Dr. W. A. Griffiths at Gunnedah.

DR. L. FITZ PATRICK has been reappointed Medical Officer of the Dubbo Hospital.

DR. H. L. MAITLAND has been elected Senior Medical Officer, and Drs. C. E. Corlette and W. J. Shirlow Junior Medical Officers at the Sydney Hospital.

member dwelt on the faulty ventilation of schoolrooms.

MR. CHARLES HENRY JOHN HOVELL, M.R.C.S. Eng. 1860, Surgeon of the R.M.S. "Monowai," died on board the steamer on March 14 between Honolulu and Apia. The deceased gentleman had practised for over 20 years in the Coromandel and Auckland districts.

DR. R. CHURCH, a graduate of the University of New Zealand, has been appointed a Medical Officer of the Mount Ida District Hospital at Naseby (Otago) in the place of Dr. J. G. Jeffreys, removed.

DR. D. COLQUHOUN, of Dunedin, has left for England on a holiday.

DR. M. COUGHTREY, of Dunedin, has erected a private hospital on his property at St. Clair, a seaside suburb of Dunedin.

DR. JOHN CUNNINGHAME, of Port Chalmers, has been appointed Acting Health Officer for the Port of Dunedin.

DR. A. E. MARSACK, late of Drs. Anderson and Marsack, of Tunbridge Wells (England), has commenced practice at Whangarei, 95 miles N. of Auckland.

DR. T. L. PAGET, a recent arrival, has settled at Stratford, 30 miles S. of New Plymouth.

QUEENSLAND.

THE Government have offered the position of Director of the Bacteriological and Pathological Institute to Dr. Loir, formerly Assistant to Dr. Pasteur, at a salary of £500. If this is accepted, Dr. Loir, who is now in Paris, will be entrusted with the purchase of a complete apparatus for furnishing the laboratory.

OVER 40 inches of rain fell in Brisbane during the month of February last.

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List of Corrections.

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AN EXAMINATION PAPER ON OSLER (4th EDITION).

THERE seems to be a certain monotony about medical examinations, so we suggest the following, by way of variety:—

1.—Who was Mephibosheth? What parental superstition dates from his time?

2.—What is "one of the saddest chapters in the history of human deception?"

3.—Give Osler's quotations from the following authors:—John Bunyan, Byron, John Cheyne, George Cheyne, Montaigne. Explain the context where necessary.

4.—Describe, if necessary, with the aid of diagrams, Kemp's double current rectal tubes. What are the indications for their employment?

5.—Give in full the name of "the distinguished old Bath physician." At what period did he flourish, and what is his claim to distinction?

6.—As a sequence, to what therapeutic procedure did the son of Professor Langerhans die? What was the pathological and medico-legal interest of the case?

7.—What is the chief recorded complication of a lay committee meeting at St. George's Hospital?

8.—Who was convinced that more wise men than fools are victims of gout? Is there any reason why he, in particular, should hold that view?

9.—What cases drift to "museums and side-shows?"

10.—How did Trousseau's patient make money?

11.—What celebrated English physician preferred to die in harness? State the cause of death.

12.—What internal evidence is there:—

(*a*) That Osler has had an unhappy experience with cheap bicycles:

(*b*) That he is interested in the history of Napoleon Buonaparte?

13.—What is O. Rosenbach's dictum on the custom of wearing stays?

14.—Quote Hunter's famous advice to Jenner.

15.—What was the counsel of Rondibilis to Panurge?

16.—How did Eryximachus treat the hiccough of Aristophanes?

17.—Give the references to Lady Mary Wortley Montagu, President Jefferson, Jerome Cardan, the Elder Scaliger, Captain Catlin, Laurence Sterne, Thomas King Chambers, Robert Druitt and Colonel Townshend.

18.—What did Strabo call "the lisping of the gout?"

19.—Give the context of the following quotations, and make explanatory remarks if necessary :—

(*a*) Cases are given after nearly every one of the specific diseases.

(*b*) I saw, some years ago, one of the most distinguished gynæcologists of Germany perform laparotomy in a case of this kind.

(*c*) The doses given by the late Alonzo Clark, of New York, may be truly termed heroic.

(*d*) In a somewhat varied post-mortem and clinical experience, no instance has fallen under my observation.

(*e*) A history of gorging with peanuts.

(*f*) I have seen Murchison himself in doubt.

(*g*) A toad-like caricature of humanity.

(*h*) From the accurate view of Laennec and Louis the profession was led away by Graves, and particularly by Niemeyer.

(*i*) One of the most powerful enemies of the American stomach at the present day.

(*k*) I had a lesson in this matter which I have never forgotten.

20.—Who was Van Helmont, and when did he live? Give a brief account of his opinion on contemporary medicine.

21.—Who made an autopsy on Dean Swift, and what did he report?

22.—What interest attaches to :—

(*a*) The Pullman car conductor from Chicago.

(*b*) The Appleton-Swain family.

(*c*) Yellow cakes at Philadelphia.

(*d*) Chancellor Ferrier.

(*e*) Master McGrath.

(*f*) Renforth the Oarsman.

(*g*) Shattock's patient.

23.—Who had a translucent head? What was the pathology of the condition?

24.—On what occasion was a surgeon entrapped by a neurotic physician?

D. M. S.[1]

[1] From the St. Thomas Hospital Gazette, London, March, 1902.

Repaired Mar 1936.

" May 1939
(was loose in covers).

WHAT IS AN "EDITION"?

TO THE EDITOR OF THE TIMES.

Sir,—An incidental reference in your current edition to the astonishing number of "editions" of a pre-war book reminds one of the ambiguous use, on the increase in recent years, of the term "edition." Frequently the word is used for "reprint," a new "edition" really being applicable only when material alteration or

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The Student's Guide to Osler.*

Some people are keen upon Taylor
When studying medicine's wiles,
While others will steal a few moments with
Wheeler
—Both excellent books in their styles—

But when of the names we are weary
(Directories muddle the brain),
We're provided by you with philosophy too
In the trite Aphorisms of Cheyne.[19]
Geography also you teach us,
Until I came under your thrall,
I don't mind confessing that Conquenessing[20]
I never had heard of at all.

Same no. 3587, of which this is a duplicate.

AN EXAMINATION PAPER ON OSLER (4th EDITION).

THERE seems to be a certain monotony about medical examinations, so we suggest the following, by way of variety:—

1.—Who was Mephibosheth? What parental superstition dates from his time?

2.—What is "one of the saddest chapters in the history of human deception?"

3.—Give Osler's quotations from the following authors:—John Bunyan, Byron, John Cheyne, George Cheyne, Montaigne. Explain the context where necessary.

4.—Describe, if necessary, with the . of diagrams, Kemp's double current rectal tubes. What are the indications for their employment?

5.—Give in full the name of "the distinguished old Bath physician." At what period did he flourish, and what is his claim to distinction?

6.—As a sequence, to what therapeutic procedure did the son of Professor Langerhans die? What was the pathological and medico-legal interest of the case?

7.—What is the chief recorded complication of a lay committee meeting at St. George's Hospital?

8.—Who was convinced that more wise men than fools are victims of gout? Is there any reason why he, in particular, should hold that view?

9.—What cases drift to "museums and side-shows?"

10.—How did Trousseau's patient make money?

11.—What celebrated English physician preferred to die in harness? State the cause of death.

12.—What internal evidence is there:—

(*a*) That Osler has had an unhappy experience with cheap bicycles:

(*b*) That he is interested in the history of Napoleon Buonaparte?

13.—What is O. Rosenbach's dictum on the custom of wearing stays?

14.—Quote Hunter's famous advice to Jenner.

15.—What was the counsel of Rondibilis to Panurge?

16.—How did Eryximachus treat the hiccough of Aristophanes?